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ACQUISITION AND RETENTION OF SOLDIERING SKILLS: REPORT OF YEAR 2 PROGRESS

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This report describes a project designed to develop and validate a convenient, practical method that individual unit commanders and training managers can use when deciding how to allocate training resources in order to maximize combat readiness. Previous project accomplishments are briefly reviewed, and activities associated with the second year of effort are described in detail. These

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Year 2 activities include: 1) A field experiment of acquisition and retention performance of Infantry tasks, using soldiers in MOS 11B. One hundred sixty-five (165) soldiers were trained on 27 tasks and tested for recall at two-month intervals. Also, the effects of overtraining, previous testing, and soldier abilities (i.e., AFQT and ASVAB composite scores) were examined. 2) The development of a User's Decision Aid, which used ratings of task characteristics to estimate retention functions for each task. 3) The assessment of the relationship between the predicted and empirically obtained retention functions.

Results indicated that it was possible to estimate soldiers' proficiency accurately over time, using the User's Decision Aid ratings. Also, the field experiment demonstrated that, for many tasks, retention could be improved by overtraining. Soldier abilities were not systematically related to performance.

ACQUISITION AND RETENTION OF SOLDIERING SKILLS:
REPORT OF YEAR 2 PROGRESS

BRIEF

Requirement:

To develop and validate a convenient, practical method that individual unit commanders and training managers can use when deciding how to allocate training resources in order to maximize combat readiness.

Procedure:

This report describes the second year of a three-year effort. Previous project accomplishments are briefly reviewed, and activities associated with the second year of effort are described in detail. These Year 2 activities include: 1) A field experiment of acquisition and retention performance of Infantry tasks, using soldiers in MOS 11B. Approximately 165 soldiers were trained on 27 tasks and tested for recall at two-month intervals. Also, the effects of overtraining, previous testing, and soldier abilities (i.e., AFQT and ASVAB composite scores) were examined. 2) The development of a User's Decision Aid, which uses ratings of task characteristics to estimate retention functions for each task. 3) The assessment of the relationship between the predicted and empirically obtained retention functions.

Findings:

Results indicated that it was possible to estimate soldiers' proficiency accurately over time, using the User's Decision Aid ratings. Also, the field experiment demonstrated that, for many tasks, retention could be improved by overtraining. Soldier abilities were not systematically related to performance.

Utilization of Findings:

Applications of the User's Decision Aid to estimate proficiency levels over time could prove useful in several ways. Short and long-term scheduling of training and retraining could be improved. Should further evaluations of the User's Decision Aid add support for its predictive validity, generalization to other MOSs could be made. Supported by unit-specific information regarding training history, the User's Decision Aid could easily be integrated into existing Battalion Training Management Systems.

ACKNOWLEDGEMENTS

Many people within AIR and HumRRO assisted with the work described in this report. The authors especially appreciate the work of Daniel Felker, AIR, in helping to implement data collection and of Roy Campbell, HumRRO, in designing tests for data collection.

Data were collected in the Seventh Division at Fort Ord, California. The G-3 (Tasking) office coordinated support for the project. CPT Glasser and SFC Chavez were primarily responsible for arranging the support.

Data collection was made possible through the cooperation of the 3rd Battalion, 17th Infantry of the Seventh Infantry Division at Fort Ord, California. People throughout the battalion supported the project. The assistance of the following six people warrants special mention:

- CPT Blackburn, Company Commander of B Co., and 1LT Purkis, Executive Officer of C Co., provided initial guidance on task selection and valuable assistance in designing test materials.
- 2LT Trotter, B Co., and 2LT Laburcherie, C Co., provided information on training activities during retention intervals.
- First Sergeant Ferguson, B Co., and First Sergeant Pocaique, C Co., were instrumental in assuring the availability of equipment, scorers, and soldiers to be tested.

Twenty-one NCOs administered tests and conducted training:

B Co 3/17

SSG Thomas L. Barber
CPL Bobby R. Bass
CPL Robert Blanco
SGT Gary L. Brown
CPL Martin P. Dulfon
CPL Audwin C. Frisby
SGT Wayne A. Hatfill
CPL Stephen J. Hunter
CPL Keith A. Lingford
CPL Gilbert N. Lopez
CPL Jessie F. Lyles
CPL Charles Robinson
CPL Thomas Washington
CPL Samuel W. Watkins
CPL Kirk D. Wood
SSG Randal W. Zipperer

C Co

SSG Filmer Kewanyama
SGT Gerald D. McGee
SSG Raimundo Robles
SGT Ronald W. Stanley, Jr.
SGT Calvin E. Woolard

All these scorers demonstrated consistently high patience and perseverance.

Finally, we welcome the opportunity to acknowledge the cooperation of the soldiers in MOS 11B who were tested. Although the project activities were demanding and did not have a direct influence on their careers, the young men tested maintained a high level of discipline and, at times, enthusiasm which greatly facilitated the work.

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I. INTRODUCTION

A major function of the Army is to train and maintain combat-ready troops. Providing effective training management within the time and resource constraints of the unit requires unit commanders and training managers to determine:

- which soldiers need training and/or retraining
- which tasks need to be trained and/or retrained
- when training and retraining should be scheduled
- how much retraining will be required to regain proficiency.

Performance on any task declines if the task is not practiced periodically. However, different tasks and different soldiers have different rates of performance deterioration (cf. Schendel, Shields, & Katz, 1978; Hagman & Rose, 1983).* Increasing the effectiveness of training management, therefore, depends on the training manager's estimation of how rapidly performance will deteriorate for each task and for each soldier. Important factors for training managers to consider are: (1) individual differences among soldiers in their rate of performance deterioration; (2) the differences among tasks in their rate of performance deterioration; and (3) the amount of time and resources necessary to retrain soldiers back to acceptable proficiency levels.

It is not feasible to test large numbers of soldiers on each Army task to find out the different rates of performance deterioration, individual soldier differences in rate of deterioration, and retraining requirements. However, one can use theoretical and empirical research to identify categories of tasks and their component skills most likely to require frequent or infrequent training to maintain proficiency, the general kinds of soldiers most likely to require retraining, and the kinds and amounts of on-the-job practice most likely to maximize combat readiness.

Identification of these task, soldier, and training characteristics is the goal of this project. Our intent is to produce a convenient, practical method that individual

*J.D. Schendel, J.L. Shields, & M.S. Katz. Retention of motor skills: Review. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1978.

J.D. Hagman & A.M. Rose. Retention of military tasks: A review. Human Factors, 1983, 25(2), 199-213.

unit commanders and training managers can use when deciding how to allocate training resources in order to maximize combat readiness.

Four specific objectives of the project have been identified:

- to determine task characteristics that influence acquisition, retention, and relearning;
- to identify soldier characteristics that influence acquisition, retention, and relearning;
- to develop a method to predict individual task retention and relearning functions; and
- to combine this information into a format that Army training managers can use in the field to assess training needs and to increase training effectiveness within the unit.

Our approach for meeting these specific objectives consists of several tasks. First, we have reviewed experimental and theoretical literature concerning acquisition, retention, and relearning for different tasks, soldiers, and time intervals. Second, we have developed a Task Classification System (TCS) that forecasts retention and relearning functions for different kinds of tasks. This TCS will form the core of the ultimate training allocation method. Third, we have been conducting a series of field experiments to generate retention and relearning rates for different kinds of tasks in several Military Occupational Specialties (MOSs), and to determine the relationships between these functions and soldiers' ability levels, their skill levels at the end of Advanced Individual Training (AIT), and their training regimen. Finally, we are developing a "User's Decision Aid" for use in the field that generates estimates of soldier proficiency levels for individual tasks, tailored to individual field units (companies, platoons, etc.).

This project is now in its third year. This report briefly reviews and summarizes the tasks conducted and the results achieved during the first year, and describes in detail the activities associated with the second year of effort.

Summary of Year One Results

The first year of research was devoted to three major tasks: (1) conducting a literature review; (2) beginning the development of the TCS; and (3) collecting performance data in the field on a sample of military tasks.

Literature review. During the first three months of the project (December - February 1981), journal articles and technical reports pertaining to acquisition and retention were reviewed, with primary focus on those projects conducted or supported by the Army Research Institute (ARI), using Army tasks performed in Army settings. Sixteen ARI reports were analyzed. In some cases the original data were obtained and additional statistical analyses performed to extend the original findings.

Several of the ARI projects investigated training variables that influence skill retention. These included the effects of overtraining, the effects of training schedule (e.g., spacing vs. massing of repetitions), the effects of refresher training, and the effects of innovative training techniques, such as the use of mnemonics.

The results of these projects showed that: (a) Overtraining (e.g., additional practice after the soldier had performed a task correctly) improved task retention; (b) Inclusion of additional test trials and the spacing of repetitions during training were also effective in promoting retention; and (c) Innovative instructional techniques such as the use of mnemonics could enhance learning under some conditions (e.g., for tasks involving primarily the recall of verbal information).

Other ARI projects examined the influence of different task characteristics on retention. Task characteristics that were investigated included difficulty, interstep cueing, step "relevance" (i.e., its perceived connection to the task), and required number of steps. In general, this research confirmed that these task dimensions affected retention; also, several other task characteristics of potential relevance to retention were identified.

Five of the ARI projects addressed the question of predicting retention from individual ability measures (e.g., AFQT and ASVAB scores). While the findings in these projects were inconclusive, there was consensus that such effects existed. What is necessary to firmly establish and quantify these effects is a more thorough approach to the measurement of multi-dimensional differences in individuals.

The literature review had several implications for other segments of this project. The TCS was structured around a set of task characteristics presumed to be related to

retention; the literature review was instrumental in revealing many of these characteristics. Furthermore, the literature review directed our attention to certain variables whose relationship to acquisition and retention clearly needed further empirical study. These variables -- training strategy, individual soldier differences, task characteristics, and practice -- provided a basis for the set of independent variables underlying our field data collection effort.

Task Classification System. During Year One, we first constructed a preliminary TCS based on the results of the literature review, and then evaluated it. Construction of the TCS involved specifying task characteristics, operationalizing their definitions, developing rating scales and anchor points, and determining scale weights and scale score combination rules.

For the TCS evaluation, five senior members of the project staff rated a sample of forty Army tasks using the preliminary version of the TCS. The resulting ratings were then analyzed to determine interrater reliability, within-dimension variability, and correlations among dimensions.

Based on these analyses, several changes were made in the TCS. The rating dimensions were redefined by establishing a common frame of reference for the raters (by defining a typical soldier and the typical experience of that soldier); benchmarks were defined to help clarify the rating scales; and, in situations where there could be a true zero on the dimension, the "0" rating was assigned.

At the end of Year One the TCS contained eleven dimensions related to military task performance. These dimensions were organized into three general categories:

- Enabling Skills: dimensions concerned with skills that are adjunct to the task but that enable it to be performed (e.g., "Use of Auxiliary Equipment");

- Task Characteristics: dimensions concerned with the steps required for task performance, the relationships among steps, and the information-processing requirements of steps (e.g., "Number of Steps"); and

- Criterion Characteristics: dimensions concerned with the performance criteria (e.g., "Consequences of Error").

Field data collection. Data were collected in the field to determine the effects of certain variables on task retention. The specific variables examined were those indicated in the literature to be important determinants of retention: length of no-practice interval, individual difference variables, degree of initial learning, and task characteristics.

During the second half of 1981, we collected acquisition, retention and relearning data for a sample of tasks performed by Track Vehicle Mechanics, 63N MOS. Data were collected at Forts Riley, Stewart, Knox, and Hood.

The general approach for data collection was to administer and score hands-on tests for each of six tasks to each mechanic on two occasions. During the first occasion (i.e., the acquisition phase), mechanics were tested and scored on the tasks, given feedback regarding accuracy, and then asked to repeat the task until they achieved proficiency (i.e., one correct performance). They then received extra training on half the tasks, consisting of two extra "test-feedback-retest" cycles. That is, each soldier was tested and scored, given feedback, and retested until they performed the task correctly twice more. We called this "mastery" training. About two months later, the same hands-on tests given during acquisition were given again to determine retention. Following the retention test, mechanics relearned each task back to proficiency. The basic experimental design is shown in Figure 1.

We selected tasks that met three criteria: they were representative of a wide range of Army maintenance functions; they could be administered within the time and equipment constraints at the Fork Knox Armor Center and at the selected posts; and they represented a range of the task characteristics hypothesized to be related to the TCS. For example, the tasks selected represented three levels of task length: more than 20 steps, 10 - 19 steps, and less than 10 steps.

After selecting the tasks for training and testing, we developed hands-on tests for each of the tasks. Several steps were taken to maximize test reliability and validity. These included careful preparation of the scoresheets, a lengthy review of the scoresheets with the instructors, preparation of administrative instructions, tryouts to examine and check interrater reliability, and a review of the tests by the proponent agency. Based on the review by the Ordnance School, a "maintenance efficiency checklist" was developed for each task. This checklist included aspects of the mechanic's job that were not typically scored on standard MOS tests, such as proper handling of tools and equipment.

Six scorers were hired to conduct the tests. Each scorer had recent military experience as a maintenance officer or NCO (non-commissioned officer) and experience as

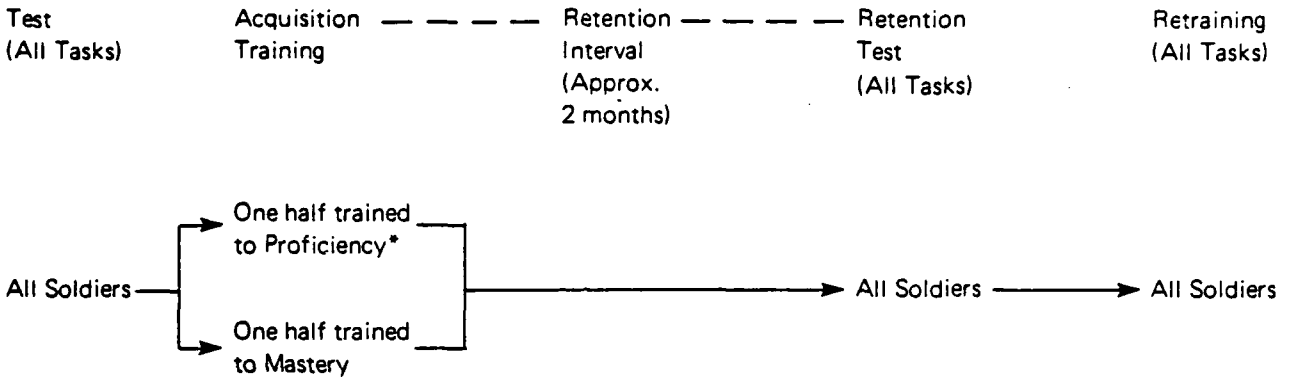


Figure 1. Basic experimental design.

*Each soldier received proficiency training (i.e., one correct trial) on three tasks and mastery training (i.e., three correct trials) on the remaining three tasks.

an instructor. Four had worked as instructors in the maintenance department at Fort Knox.

During acquisition testing, we collected data from 116 Track Vehicle Mechanics, 63N MOS. All but one were in Skill Level 1 (E1 through E4); the exception was an E5. All were AIT graduates. Of the 116 mechanics originally trained, 21 were unavailable for the retention testing.

The general picture of acquisition and retention performance is as follows:

(1) Acquisition - Performance was scored in three ways: number of steps GO, percentage of mechanics GO (i.e., performing a task without errors), and time. Since, during acquisition, the soldiers who received Mastery training were scored on the first trial of each of the "test-feedback-retest" cycles, we were able to assess the acquisition function for each task. Thus, for the Mastery group, number of steps GO increased for all tasks from the first to the second repetition, where almost perfect performance was reached. For example, the mean number of steps GO for the first attempt on each of the three repetitions of "Adjust Brakes on the M60" (a 25-step task) were 21.8, 24.6, and 24.8.

For the percentage of mechanics GO, practically all mechanics made some errors on the first acquisition trial. The percentage of mechanics GO increased for all tasks across the three repetitions. For example, on "Install and Adjust Carburetor," the percentages of mechanics GO for the three repetitions were 0%, 40%, and 71%. (The reader should keep in mind that all of the mechanics were trained and retested until they performed each task without error; in other words, when they completed the acquisition phase, all mechanics had performed all of the tasks correctly on their final trial.)

Time (measured as total task performance time in minutes) decreased dramatically across acquisition for all tasks. The shapes of these acquisition functions followed a typical negatively accelerated function consistently across tasks. These decreases were substantial; by the third repetition, time was approximately halved. For example, the time taken to "Troubleshoot the Armored Personnel Carrier" decreased from 28.0 minutes to 17.4 minutes to 14.1 minutes across the three repetitions.

(2) Retention. On retesting approximately two months after acquisition, there was little or no forgetting in terms of number of steps performed correctly for any task. Performance was virtually perfect, with a mean of less than one error per task. For example, on "Adjust Brakes," the "proficiency" group (with one correct trial during acquisition) got 24.26 steps correct, while the "mastery" group (with three correct trials during acquisition) got 24.60 steps correct.

A slightly different picture is given by the retention data for the percentage of mechanics GO: on this measure, there were decreases for some tasks for both the mastery and proficiency groups. For example, only 46% of the "proficiency" group and 50% of the "mastery" group performed "Adjust Brakes" without error. The apparent discrepancy between these results and the results above for the number of steps performed correctly can be explained by the fact that mechanics who did not perform the tasks correctly made only one or two errors on the retention trial.

Retention performance for the time measure showed forgetting: time to complete a task increased substantially for all tasks. This retention loss was unsystematic across tasks; while performance for all tasks slowed down compared to the last trial of acquisition, some tasks slowed down more than others.

Another way of examining these retention effects is to consider the amount of change in performance as a function of the preceding trial. The mastery group had a net improvement of 14% in accuracy (defined by percentage of steps GO and the percentage of soldiers GO) from the first to the second trial of acquisition for "Adjust Brakes," an additional gain of 1% from trial 2 to trial 3, and no change between trial 4 (their retention trial) and trial 3 (their last trial of acquisition). The proficiency group (who received only one acquisition trial) gained 16% from trial 1 (their last acquisition trial) to trial 2 (their retention trial). There is a remarkable similarity between the gains achieved from the first to the second trials, despite the fact that for one group the second trial occurred immediately, while for the other it occurred two months later. More simply put, the retention interval had no effect on forgetting.

The key to understanding these results lies in the fact that performance in the 63N MOS is aided by technical manuals (TMs). Mechanics used these manuals while performing all tasks. Thus, all a mechanic needs to do is follow the manual to perform any task in the MOS. In fact, mechanics in our experiment used their manuals perforce; the first performance step on each task was "Soldier opens his TM to page X." If a soldier neglected to do this, he was prompted and <u>told</u> to use the manual. Given that the manual was always used, few if any errors would be expected. The sole sources of errors would be ambiguities or deficiencies in the TMs themselves or the mechanic's lack of familiarity with specific tools.

One further assumption accounts for practically all of the results: performance of 63N tasks is normally untimed (i.e., there are no prescribed time limits). We speculate that mechanics "took their time and did it right" during the retention test, thus accounting for the slower performance times.

Retention performance was not related systematically to soldier ability, as measured by ASVAB or AFQT scores. This might have been expected, since all mechanics were trained to the same criteria during acquisition. Retention differences among different aptitude groups tend to show up when different levels of acquisition are allowed to occur across high and low ability groups (Hagman & Rose, op. cit.).

Also, retention performance was not related systematically to degree of original training (i.e., proficiency vs. mastery), other than what was described above. Furthermore, there were no interactions among the major experimental variables (training, ability, and retention interval).

With regard to relearning, there were no systematic effects related to ability or task differences. This was due to lack of variance: relearning of all tasks was complete within two trials.

These results did not shed much light on variables affecting acquisition and retention of skills, other than to indicate the importance of job aids. Thus, the focus of Year Two data collection was to be on acquisition and retention of skills for soldiers in an MOS that involved non-job-aided tasks.

II. YEAR TWO: ACQUISITION AND RETENTION OF INFANTRY TASKS

A major activity during Year Two was the collection of acquisition and retention data for a sample of 11B10 (Infantryman) tasks performed by job incumbents. The goals of this activity were:

- to empirically establish the acquisition, retention, and relearning functions for a wide variety of Infantry tasks;
- to continue the exploration of the effects of soldier abilities, level of initial learning, task characteristics, and retention interval on retention for tasks that are not job-aided; and
- to provide criterion data for the assessment of the validity of the TCS.

Method

Selection of MOS

The MOS for Year Two was 11B10, Infantryman. Two characteristics of this MOS led to its selection. First, the job incumbents in this MOS are involved in the Cohesion Operational Readiness and Training (COHORT) program. Under this program, an entire company is assigned after AIT to the same unit at the same post; furthermore, the company remains together throughout their first tour. Thus, COHORT units have little personnel turbulence, thereby enhancing the feasibility of a longitudinal research design. The second characteristic of this MOS is that most of its tasks must be performed without job aids (in contrast to the maintenance MOS that was the focus for Year One).

Selection of Tasks

We selected tasks meeting four criteria:

1. The task was contained in the 11B Skill Level 1 Soldier's Manual (SM).
2. The task was not going to be included in the 11B Skill Qualification Test (SQT) hands-on component, SQT skill component, or Expert Infantry Badge (EIB) tests, scheduled for administration during our data collection. This exclusion did not apply to parts of SQT tasks (e.g., although "Use Visual Signals to Control Movement" was part of the SQT, we used a set of signals not contained in the test), nor did we

exclude tasks that were to be covered on the SQT job site component (JSC), since only a few of the soldiers in our sample would be taking this test.

3. The administrative demands for the task could fit our requirements for testing 200 soldiers in two weeks using eight scorers.

4. The tasks would sample a range of task characteristics identified in the TCS.

We selected specific tasks from two sources. The primary source was the End-Of-Course (EOC) test given at AIT. The other source was the recommendations of representatives of the supporting companies.

Test Development

We developed a hands-on test for each task. Each test consisted of a scoresheet and administrative instructions. To the extent possible we incorporated scoresheets for EOC and JSC tests into the project. For the tasks not covered in EOC or SQT we developed scoresheets based on task detailing in the 11B Skill Level 1 SM (FM 7-11B1/2, July 1978).

Administrative instructions followed the same format as SQT hands-on tests. We developed the following sections for each test:

- An equipment list that specifies tools, weapons, and materiel required for the station
- Instructions to the scorer on how to set up the test site
- Instructions to the scorer on how to standardize the test conditions for each soldier tested
- Instructions to the scorer on how to return the equipment to pretest status.

The final step in test development was to conduct a tryout of the draft scoresheets and administrative instructions. The tryout checked consonance with unit doctrine and administrative feasibility. It was conducted with eight Skill Level 2 scorers and five Skill Level 1 soldiers from the supporting companies. Four scorers simultaneously rated each Skill Level 1 soldier's performance on each task. After each soldier performed the task, the scorers discussed their ratings of the performance. Disagreements among scorers were resolved through discussion of doctrine governing the task or revision of the scoresheets.

We deleted two of the 20 tasks involved in the tryout: "Use Limited Visibility Technique with the M203 Grenade Launcher," because it required too much time; and "Zero Nightsight," because of uncertainty over the doctrine caused by a revision in the zeroing target. The test approaches for the remaining 18 tasks are described in Table 1. The tests themselves are included in Appendix A.

Data Collection

We collected data in four phases. During the first phase, which we called "Acquisition," all soldiers in the project were tested and trained on all tasks. During the second phase, about two months later, we tested one third of the soldiers on all the tasks. During the third phase, four months after Acquisition, we tested the soldiers from phase two and another one-third of the original group; the purpose of this retesting was to determine the effects of testing on retention. During phase four, six months after Acquisition, we retested and retrained all soldiers in the project. No retraining occurred during the second and third phase. The experimental design is shown in Figure 2.

Scorers. The supporting units provided NCOs to score the tests. The set of tests required eight scorers for each phase. Although we had planned to use the same scorers for each phase, a total of 17 NCOs served as scorers. Training for each scorer included the rating of several performances of each task. The tasks were performed by other scorers who committed errors as directed by project staff.

Subjects. We collected data from 165 soldiers in four companies from one battalion stationed at Fort Ord, CA. All soldiers were at Skill Level 1 at the time of the Acquisition phase. Three of the companies were COHORT companies; the remaining soldiers, from the CSC (Headquarters) company, were supplied by the battalion to fill the requirements in the Troop Support Request. The distribution of soldiers by company and MOS is shown in Table 2.

Sixteen of the COHORT soldiers had graduated from AIT about three months prior to the Acquisition phase; the remaining 139 COHORT soldiers had graduated from AIT about nine months previously. The ten soldiers from CSC had graduated from AIT between one and three years prior to the test.

AFQT Percentile scores were obtained for 154 of the soldiers, and ASVAB aptitude area composite scores were obtained for 143 soldiers. Descriptive data for these scores are shown in Table 3. (The Army calculates AFQT scores by combining three or four of the ASVAB scores [depending upon which ASVAB form was administered] and then applying a

Table 1

Test Approaches For Tasks Tested At All Phases

Station	Task	Basis	Approach
1	Collect/Report information-SALUTE	EOC	A display of enemy activity was set up about 150 meters from the test site. The display included two soldiers wearing mock OPFOR helmets and carrying OPFOR weapons (training aids). Both were in a 1/4-ton truck. One was operating the radio (for Station 2). The tested soldier was given one minute to observe the scene and one minute to prepare his report. Scoring was based on his format.
	Use visual signals to control movement (dismounted)	SM	The scorer told the soldier the name of a signal. The soldier had 10 seconds to give the signal. (For the EOC test the soldier had to name three signals which the scorer gave.) The test in the project included nine signals that were not covered by SQT.
2	Install radio set AN/PRC-77 for operation	EOC, JSC	For the project the soldier assembled the radio and conducted a commo check. (EOC had the scorer conduct the commo check.) The tryout illuminated the need for more detail on the commo check than was in the JSC test.
	Transmit and receive a radio message	SM	The soldier was given one of four messages. Each message included a location which had to be spelled and a date-time group. The soldier had one minute to prepare his transmission. He was scored on radio telephone procedures (including the I SPELL proword), phonetic alphabet, and numbers (such as nines). The messages were varied by occasion tested.

Table 1 (Con'd.)

Station	Task	Basis	Approach
2	Install telephone set (TA-1/PT)	EOC	The soldier stripped the ends of a field wire, connected them to the telephone, and turned the volume switch. (EOC test did not include stripping wire.)
3	Identify friendly and threat (OPFOR) armored vehicles	EIB	The soldier was shown cards from the ARI Combat Vehicle Identification (CVI) program. The cards are photos of models on a standard background. (For EIB the soldier was shown line drawings.) The soldier had to identify 10 vehicles as friend or foe and five vehicles by nomenclature.
4	Install the AN/PVS-2 Nightsight	SM	The soldier had to install the adapter on the weapon and install the nightsight on the adapter.
	Identify and employ hand grenades	SM	The soldier was shown a flip chart with colored drawings of nine hand grenades. The scorer described 12 situations and asked the soldier which grenade he would select. The soldier pointed to the picture of his selection. For some situations several grenades could be used. Most grenades were used more than once. (The task was tested in EOC with a color chart of five grenades. The solder had to react to one situation for one grenade and name the remaining four.)
5	Load, reduce a stoppage, and clear an M16A1 rifle	EOC	The soldier had to perform the operations the same as for the EOC test. The test requires steps and sequence that are frequently ignored.

Table 1 (Con'd.)

Station	Task	Basis	Approach
5	Battlesight zero an M16A1 rifle	SM	The soldier was given a battlesight zero target with a shot group marked on it. He had to adjust the sights based on the shot group. The original test was based on a zero target that had since been replaced with the ARI target. The ARI target has a more readable grid arrangement with clear instructions on applying adjustments. Based on the tryouts, the test was revised to include the ARI target.
6	Load, unload and clear an M203 grenade launcher	EOC	The soldier had to perform the operations the same as for the EOC TEST. None of the operations is complicated.
	Perform operator maintenance on M203 grenade launcher and ammunition	JSC	The soldier had to disassemble, assemble, and perform a functions check. The JSC test called for cleaning and gave no detail on the function check. The test for the project did not include cleaning and broke the function check into steps as listed in the SM.
	Prepare Dragon for firing	JSC	The only difference between the JSC test and the project test is that the project test scored removal of the electrical cover from the round.

Table 1 (Con'd.)

Station	Task	Basis	Approach
7	Stop bleeding (arm or leg)	EOC	The soldier performed this task on a scorer assistant. For the project test the scorer told the soldier that the wound was bleeding after the bandage was first applied. After the soldier applied pressure, the scorer told him the bleeding had stopped. We required tight square knots. The EOC test required the soldier to apply pressure with no cues and, after being told that bleeding continued, to apply a pressure bandage. The EOC test did not require square knots and encouraged loose knots to ease administration.
	Identify signs of and treat for shock	EOC	This test was conducted in conjunction with the Stop Bleeding test. The soldier was told that the casualty was showing symptoms of shock. He had to loosen the casualty's clothing, elevate the casualty's feet, and cover the casualty. The EOC test had the scorer assistant act troubled and scored whether the soldier reacted calmly. The tryouts indicated that that approach would probably not be treated seriously by the soldiers in the sample.
	Splint a fracture	JSC	The fracture for this test was a straight elbow. In order to immobilize the joint above and below the fracture, the soldier had to apply a splint that extended from the wrist to the shoulder. When we checked at the battalion aid station to get a splint that length we were told that the correct splint was a wire ladder. To test whether the soldier knew that the splint should extend beyond the shoulder and wrist we laid out three splints: two standard short wood splints and the wire ladder.

Table 1 (Con'd.)

Station	Task	Basis	Approach
8	Determine azimuths using a coordinate scale and protractor	SM	The soldier had to measure the azimuth between two points, then compute two back azimuths--one that required additions and one that required subtraction. The scorer varied the points and azimuths among trials and soldiers.
	Convert azimuths (magnetic or grid)	SM	The soldier had to convert two azimuths: one from magnetic to grid the other from grid to magnetic. He used the declination diagram on the map he used to determine azimuths.

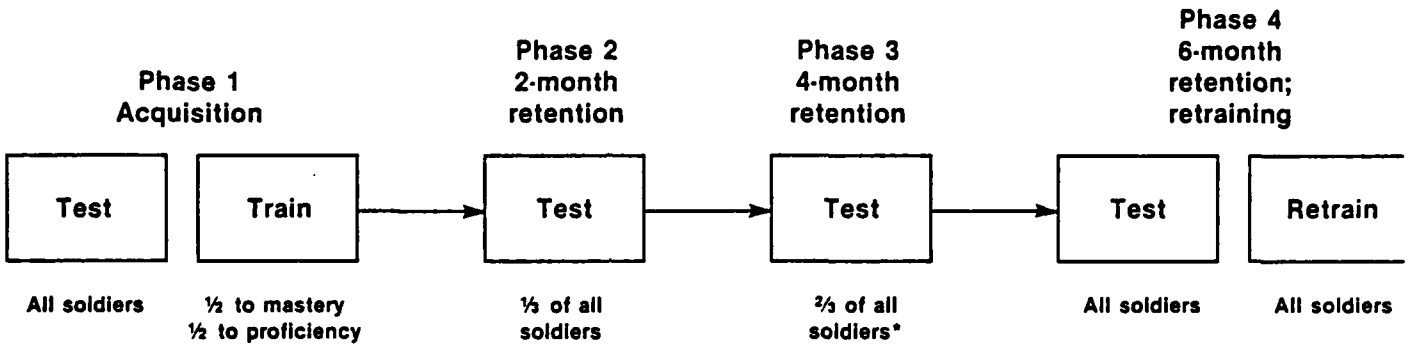


Figure 2. Basic experimental design for year 2 data collection.

*This group includes the soldiers tested at Phase 2.

Table 2

Distribution of Soldiers By Company and MOS

Company	MOS 11B	MOS 11C	Months Between OSUT and Acquisition
A Co	16	-	3
B Co	51	7	9
C Co	81	-	8
CSC	10	-	Non-COHORT (1-3 years)
	158	7	

Table 3
Mean ASVAB Scores for Soldiers Participating in Acquisition Test

Composite	Mean	Standard Deviation	Minimum	Maximum	N
AFQT Percentile Score	44.57	20.18	16	93	154
Combat	100.31	11.22	85	137	143
Field Artillery	99.06	12.21	75	135	143
Electronics Repair	96.45	13.65	65	147	143
Operators/Food	97.32	12.96	68	137	143
Surveillance/Communication	97.60	13.13	74	138	142
Mechanical Maintenance	97.43	13.04	67	138	143
General Maintenance	95.06	15.71	53	151	143
Clerical	97.29	12.44	73	129	143
Skilled Technical	96.34	14.37	64	153	143
General Technical	98.32	13.48	60	135	142

nonlinear conversion to the total. We were unable to obtain the information necessary to convert ASVAB scores to AFQT Percentiles; hence the discrepancy between the numbers of soldiers with one score or the other.)

The project was designed to retest, at least once, all soldiers tested and trained during the Acquisition phase. Although most of the soldiers were from COHORT companies, we expected some attrition at each phase. As shown in Table 4, attrition ranged from 16% - 30%. The highest attrition occurred during the four-month test, which was conducted just before Christmas. Of the 165 soldiers tested during acquisition, 136 (82%) were tested at least once during the retention phase. The causes of attrition at each phase were unrelated to project activities. They are shown in Table 5.

Acquisition Phase Procedures. Hands-on tests covering the selected tasks were administered first during the Acquisition phase. If a soldier made a mistake during the test, the scorer told him what his error was after the test was finished and had him perform the task again until he did it without error. If a soldier was unable to do the task at all, the scorer initially talked him through it. During the talk-through the scorer told the soldier each step to perform and demonstrated steps if necessary. After the talk-through, the soldier performed the task as if he were being tested for the first time.

After being tested on all tasks, each soldier repeated this testing-training procedure two more times on half of the tasks. That is, after completing all the tasks once correctly, each soldier returned to half of the stations, where he repeated each task until it was performed without error; this "repeat cycle" was done twice so that each soldier completed three errorless performances on half of the tasks. Soldiers were assigned randomly to repeat the tasks in one of the clusters shown in Table 6. The test conditions and treatment of errors were the same each time a soldier was tested. In this report, we call the soldiers who performed a task correctly once, "proficient" and those who performed the task correctly three times, "masters."

Each step that a soldier omitted or did wrong on the first trial was scored "NO-GO" on the scoresheet. The scorer also recorded the time for the first trial and the number of trials until the soldier did the task without error.

Retention Test Procedures. Soldiers tested at the two-month and four-month intervals were asked to perform each task one time with no assistance or feedback. Scorers were told not to give soldiers any information about their overall performance ("GO" or "NO-GO") or about specific steps.

Table 4

Number of Soldiers Tested at Each Test Phase

	Acquisition	2 Month	4 Month	6 Month
Number Projected		63	113	165
Number Tested	165	53	79	123
Percent Not Tested		16	30	35

Table 5

Causes of Attrition at Retention Phases (Frequencies)

	2 Month	4 Month	6 Month
Other Duty	1	5	11
Discharge	2	7	8
PCS/Transfer	1	3	7
School	1	6	4
AWOL	1	1	3
Sickness	0	2	2
ETS	1	1	2
Death	0	1	2
Leave	3	6	1
Jail	0	0	2
Other	—	2	—
TOTAL	10	34	42

Table 6

Clusters for Additional Trials

A	B
Collect/Report information-SALUTE	Identify friendly and threat (OPFOR) armored vehicles
Use visual signals to control movement (dismounted)	Load, reduce a stoppage, and clear an M16A1 rifle
Install radio set AN/PRC-77 for operation	Battlesight zero an M16A1 rifle
Transmit and receive a radio message	Load, Unload, and clear an M203 grenade launcher
Install telephone set (TA-1/PT)	Perform operator maintenance on M203 grenade launcher and ammunition
Install the AN/PVS-2 Nightsight	Prepare Dragon for firing
Identify and employ hand grenades	Stop bleeding (arm or leg)
Determine azimuths using a coordinate scale and protractor	Identify signs of and treat for shock
Convert azimuths (magnetic or grid)	Splint a fracture

Scorers conducted the six-month retention test the same way they conducted the initial Acquisition test. If the soldier made a mistake, the scorer told him what the mistake was and had him do the task over. The scorer also recorded the number of trials the soldier needed before he was able to do the task without error.

Generally the test conditions were the same for the retention tests as for the Acquisition phase. There were three exceptions:

- Transmit a Message. We used a different message for the retention tests. The message was in the same form but contained some different letters. This was done to test if the training given during Acquisition was form-specific.

- Prepare a Dragon for Firing. The test called for preparing the round, including removing the electrical cover on the round before removing the tracker from its bag (which protects the tracker). But, since the rounds used for the Acquisition phase did not have the cover, soldiers were not trained on the step. The rounds for the retention test did have the cover. We scored the sequence for the step and analyzed data for the task both with the step and without the step.

- Convert Azimuths (magnetic or grid). We changed the conversion factor on the map for the retention phases. This was done to test whether soldiers remembered how to find the conversion factor or whether they memorized the factor from the Acquisition phase.

As was mentioned above, the 11B SQT was scheduled for administration during the course of our field test. By readministering several of these SQT tests during phase four we were able to collect two-month retention information. Thus, at the six-month retention test, we also administered eight tests from the 11B SQT:

- Put on and wear an M17-series protective mask.

- Replace the filters in an M17-series protective mask.

- Prepare an M72A2 LAW for firing.

- Install and fire/recover an M18A2 Claymore mine.

- Use visual signals to control movement (dismounted).

- Install the M16A1 bounding antipersonnel mine (without tripwire).
- Determine a magnetic azimuth using a compass.
- Engage enemy targets with hand grenades.

We administered the same tests as the units had used for SQT with three exceptions:

- Determine a magnetic azimuth with a compass. The SQT test was product-scored. We kept that approach but added procedural steps for remediation in case a soldier made a mistake. If a soldier followed the "wrong" procedure but got the correct answer, we scored him "GO."
- Engage targets with hand grenades. The SQT approach used dummy fuzes as a means to measure whether the grenade was in the circle when it detonated. We did not use the fuzes. We required that the grenade stay within the circle.
- Install and fire an M18A1 Claymore mine. Scorers for the supporting battalion's SQT had interpreted a sequence measure more strictly than doctrinal references would support. By that interpretation soldiers had to aim the mine before securing firing wire and test the firing device at the firing point after aiming the mine but before placing the sandbag over the blasting cap. We allowed the soldier to secure the wire after aiming the mine and to test the firing device and circuit at any time before arming the mine.

Other changes were just minor modifications of the format to facilitate data analysis. The scoresheets for the SQT tasks are in Appendix B.

If a soldier made a mistake on any step of the SQT tasks, the scorer told him what the error was. For all but two tasks, soldiers repeated the SQT tasks until they did them without error. The exceptions were the very long "Replace the filters in an M17-series protective mask" and "Install and fire/recover an M18A1 Claymore mine."

Results

Several tasks in this experiment are made up of more than one major subtask. For example, "Load, Reduce Stoppage, and Clear an M16A1 Rifle" has three distinct parts, with

different task characteristics. To determine whether these subtasks had different acquisition, retention, and relearning functions, and for various other statistical analyses (e.g., performance prediction), we separated six of the original 18 tasks into smaller units, each of which dealt with a specific procedure. "Load, Reduce Stoppage and Clear an M16A1 Rifle" and "Clear, Load and Unload an M203 Grenade Launcher," originally comprising two tasks, were scored as six separate tasks. "Perform Operator Maintenance on M203 Grenade Launcher" was scored as "Disassemble M203," "Assemble M203," and "Function Check M203." "Identify Armored Vehicles" was separated into "Friend-Foe" and "Nomenclature." "Determine Azimuth" was divided into "Determine Azimuth" and "Find Back Azimuth." "Operate Radio Set" was separated into "Install Radio" and "Enter the Net." These divisions of the original 18 task categories resulted in 27 experimental tasks for which data were analyzed.

Performance measures and predictors. We used several measures to examine soldiers' performance. Individual soldiers were characterized by the percentage of task steps they completed correctly and whether or not they were "GO" on each task. We also recorded the time taken to complete a task. To characterize group performance, we computed the percentage of soldiers who were "GO" on each task, as well as the mean percentage of steps correct and the mean performance time.

Soldiers were asked how frequently they performed each of the tasks selected for testing, and the date of their most recent performance. Their responses were converted to a frequency score of 1 or 0, depending on whether or not they reported having performed the task, and a recency score of 1 or 0, depending on whether or not they reported performing the task within the previous month. These recency/frequency data were collected during each testing phase; thus, at Acquisition, recency/frequency data were referenced to previous training, while at the retention tests they were referenced to the time since the soldier was last tested.

Acquisition

First-trial performance. Recency/frequency information reported by the soldiers at Acquisition is shown in Table 7. It should be stressed that the data are self-reports; we had no independent verification from the companies involved as to the accuracy of this information.

First-trial performance measures for all soldiers are shown in Table 8. In general, soldiers did well (on all performance measures) on tasks requiring primarily physical, as opposed to primarily mental or verbal activity. For example, on their first trial, more than 90 percent of the soldiers correctly performed the tasks "Install Telephone," "Clear

Table 7
Recency and Frequency Estimates for Task Performance Prior to Acquisition Test

Task	% Soldiers Reporting They Did Task At Least Once During Last 6 Months	% Soldiers Reporting They Did Task In the Last Month
Visual Signals	87.9	40.6
SALUTE	96.8	26.1
Install Radio	98.2	38.8
Transmit Message	82.4	32.7
Install Telephone	98.2	42.4
ID Vehicles	97.6	19.4
Mount ANPVS-2 on M16A1 Rifle	50.9	11.5
Identify Grenades	92.7	10.9
Load, Reduce Stoppage and Clear M16A1	100.0	49.7
Battlesight Zero M16	100.0	26.7
Prepare Dragon	87.9	38.8
Clear, Load and Unload M203 Grenade Launcher	100.0	27.9
Disassemble, Assemble and Function Check M203	75.2	22.4
Splint Fracture	97.6	25.5
Stop Bleeding	95.8	29.7
Treat for Shock	97.6	28.5
Determine Azimuth	90.3	24.8
Convert Azimuth	84.8	26.1

Table 8
First-Trial Acquisition Performance

Task	Percentage of Soldiers "GO"	Percentage of Steps Correct		First Trial Time (Secs.)		Trials to First Criterion	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Visual Signals	44.2	72.2	*31.8*	Not Timed		1.68	*0.74*
SALUTE	55.6	90.6	*12.7*	Not Timed		1.51	*0.52*
Install Radio	72.1	94.5	*10.5*	114.87	*37.21*	1.47	*0.50*
Enter Net	17.6	24.0	*40.9*	Not Timed		2.51	*0.90*
Transmit Message	4.2	11.1	*26.6*	Not Timed		3.08	*0.81*
Vehicle ID: Friend Foe	5.5	73.0	*18.2*	Not Timed		2.35	*0.72*
Vehicle ID: Nomenclature	0.0	1.7	*10.5*	Not Timed		3.32	*0.79*
Install Telephone	94.5	98.2	*7.6*	64.32	*26.25*	1.05	*0.22*
Mount ANPVS-2 on M16A1 Rifle	21.8	24.6	*42.6*	108.21	*56.56*	1.78	*0.42*
Identify Grenades	17.4	68.8	*28.0*	Not Timed		2.13	*0.79*
Load M16	62.4	91.3	*16.4*	8.26	*2.95*	1.41	*0.51*
Reduce Stoppage M16	79.4	90.6	*24.8*	8.73	*2.60*	1.31	*0.48*
Clear M16	89.1	96.7	*12.9*	8.27	*2.01*	1.14	*0.36*
Clear M203 Grenade Launcher	97.0	97.9	*13.7*	3.93	*2.22*	1.03	*0.17*
Load M203	99.4	99.9	*1.6*	4.67	*2.01*	1.01	*0.11*
Unload M203	98.8	99.6	*3.7*	2.99	*1.58*	1.02	*0.13*
Disassemble M203	51.2	54.1	*49.2*	40.15	*23.13*	1.52	*0.56*
Assemble M203	97.6	98.5	*11.3*	37.97	*21.26*	1.02	*0.15*
Function Check M203	68.3	70.4	*45.5*	11.08	*7.20*	1.32	*0.48*
Battlesight Zero M16	75.8	90.3	*20.6*	81.51	*37.27*	1.25	*0.44*
Prepare Dragon	75.6	88.4	*29.7*	89.04	*26.45*	1.30	*0.47*
Stop Bleeding	32.7	71.2	*28.0*	82.32	*19.29*	1.68	*0.49*
Treat for Shock	69.7	85.9	*25.5*	80.34	*17.15*	1.31	*0.47*
Splint Fracture	12.1	48.4	*37.1*	248.30	*53.79*	1.92	*0.42*
Determine Azimuth	24.2	25.5	*43.3*	63.30	*40.70*	1.81	*0.72*
Back Azimuth	47.9	48.8	*49.7*	28.82	*18.86*	1.59	*0.78*
Convert Azimuth	30.9	30.9	*46.4*	32.32	*29.67*	1.74	*0.73*

M203," "Load M203," "Unload M203," and "Assemble M203." Soldiers did not do as well on tasks that required processing of verbal information, performance of complex procedures, or decisionmaking. For example, on their first trial, less than 20 percent of the soldiers correctly performed the tasks "Enter the Net," "Transmit Message," "Vehicle ID: Friend-Foe," "Vehicle ID: Nomenclature," "Identify Grenades," and "Splint Fracture." The tasks "Friend-Foe," "Nomenclature," and "ID Grenades" required matching visual stimuli with names. The tasks "Enter the Net" and "Transmit Message" required communicating information according to a set procedure. "Splint" is a manual task, but soldiers must decide which of several procedures (e.g., which splint to use, where to tie knots) is appropriate for a given situation.

Table 8 also shows the mean number of trials it took the soldiers to perform each task correctly the first time. More trials were typically required to correctly perform the mental tasks than the physical tasks. However, on the average, soldiers could perform correctly even the most difficult task, "Vehicle ID: Nomenclature," after about three trials.

We use the term "trial" cautiously here. We considered a trial to include the feedback (or training) that followed a soldier's performance. Thus, when we say that a soldier took four trials to perform a task correctly, that means he went through three cycles of "test-plus-training/feedback," then performed the task correctly on the fourth attempt. Since the feedback/training depended upon the particular errors that the soldier made, "trials" meant different things for different soldiers. And, obviously, "trials" are not comparable across tasks in any but the most superficial sense. The reader should keep this caution in mind, as "trials to criterion" will be used in later sections of these analyses as a predictor of retention performance.

Learning rates. Tables 9-11 contain the performance measures for soldiers in the Mastery and Proficiency conditions. Recall that soldiers in the Mastery condition completed three repetitions of each task, where each repetition consisted of as many trials as was necessary until the task was performed correctly. We recorded the details of their first attempt for each of the three repetitions. The Mastery soldiers' performance improvement across repetitions thus is an indicant of the "learning rate" of a task.

As is apparent in Tables 9 and 10, learning was rapid on all tasks for the two accuracy measures (percentage of soldiers "GO" and percentage of steps correct). With few exceptions (Vehicle ID, Transmit Message, Enter Net, and Identify Grenades), learning was practically complete by the second repetition.

Table 9
Percentage of Soldiers "GO" on Acquisition Test by Training Condition

Task		1st Trial Acquisition	2nd Trial Acquisition	3rd Trial Acquisition
Visual Signals	P	41.9		
	M	46.8	91.0	93.5
SALUTE	P	55.8		
	M	55.3	96.1	94.7
Install Radio	P	75.0		
	M	69.1	93.8	100.0
Enter Net	P	15.5		
	M	19.8	71.6	87.5
Transmit Message	P	2.4		
	M	6.2	60.5	81.5
Vehicle ID: Friend Foe	P	3.7		
	M	7.2	69.5	85.2
Vehicle ID: Nomenclature	P	0.0		
	M	0.0	63.9	85.5
Install Telephone	P	99.8*		
	M	90.1	100.0	100.0
Mount ANPVS-2 on M16A1 Rifle	P	23.8		
	M	19.8	92.6	96.3
Identify Grenades	P	13.1		
	M	22.5	82.1	97.1
Load M16	P	69.9*		
	M	54.9	95.9	98.5
Reduce Stoppage M16	P	78.3		
	M	80.5	95.9	97.1
Clear M16	P	88.0		
	M	90.2	90.4	94.2
Clear M203 Grenade Launcher	P	98.9		
	M	94.8	96.0	95.7
Load M203	P	98.9		
	M	100.0	98.7	100.0
Unload M203	P	97.7		
	M	100.0	98.6	100.0
Disassemble M203	P	44.8		
	M	58.4	92.1	97.1
Assemble M203	P	97.7		
	M	97.4	96.1	95.7
Function Check M203	P	57.5*		
	M	80.5	93.4	95.7
Battlesight Zero M16	P	73.5		
	M	78.1	95.0	96.2

Table 9 (continued)

Task		1st Trial Acquisition	2nd Trial Acquisition	3rd Trial Acquisition
Prepare Dragon	P	73.3		
	M	78.2	97.4	100.0
Stop Bleeding	P	35.4		
	M	30.1	90.1	97.6
Treat for Shock	P	69.5		
	M	69.9	93.9	100.0
Splint Fracture	P	18.3*		
	M	06.0	92.7	90.1
Determine Azimuth	P	25.0		
	M	23.5	100.0	100.0
Back Azimuth	P	50.0		
	M	45.7	00.0	100.0
Convert Azimuth	P	32.1		
	M	29.6	00.0	100.0

* Difference between means significant at .05 level.

Table 10
Mean Percentage of Steps Performed Correctly on Acquisition Test by Training Condition

Task		1st Trial Acquisition		2nd Trial Acquisition		3rd Trial Acquisition	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Visual Signals	P	69.3	32.7				
	M	75.4	30.7	98.7	4.7	99.0	4.1
SALUTE	P	89.9	14.3				
	M	91.4	10.7	98.3	11.7	99.1	3.8
Install Radio	P	95.0	10.1				
	M	94.1	10.9	98.6	5.9	100.0	0.0
Enter Net	P	22.6	39.6				
	M	25.4	42.3	93.8	10.3	97.5	6.7
Transmit Message	P	12.8	27.5				
	M	9.3	25.8	91.4	18.6	97.4	6.4
Vehicle ID: Friend Foe	P	74.8	15.7				
	M	71.3	20.4	95.1	8.5	98.5	3.6
Vehicle ID: Nomenclature	P	1.7	11.0				
	M	1.7	10.0	87.8	19.8	97.0	8.4
Install Telephone	P	99.6*	36.3				
	M	96.7	10.0	100.0	0.0	100.0	0.0
Mount ANPVS-2 on M16A1 Rifle	P	25.0	42.9				
	M	22.9	41.8	99.2	2.9	99.6	2.1
Identify Grenades	P	67.8	27.7				
	M	70.1	28.5	97.4	6.7	99.6	2.2
Load M16	P	92.9*	14.9				
	M	89.5	17.7	99.6	2.3	99.8	1.7
Reduce Stoppage M16	P	89.2	26.9				
	M	92.1	22.6	99.5	2.7	99.5	2.8
Clear M16	P	95.2	17.2				
	M	98.2	5.9	98.6	4.6	99.0	3.9
Clear M203 Grenade Launcher	P	98.9	10.7				
	M	96.8	16.5	99.3	3.3	99.3	3.4
Load M203	P	99.8	2.1				
	M	100.0	0.0	99.7	2.3	100.0	0.0
Unload M203	P	99.9	5.0				
	M	100.0	0.0	99.6	3.8	100.0	0.0
Disassemble M203	P	50.1	49.1				
	M	58.7	49.3	98.4	5.4	99.4	3.4
Assemble M203	P	97.7	15.1				
	M	99.4	4.0	99.0	4.9	98.9	5.1
Function Check M203	P	58.5*	49.5				
	M	83.8	36.4	98.4	6.3	98.7	6.2
Battlesight Zero M16	P	88.0	24.8				
	M	92.7	15.0	98.4	7.3	99.1	4.8

Table 10 (continued)

Task		1st Trial Acquisition		2nd Trial Acquisition		3rd Trial Acquisition	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Prepare Dragon	P	88.1	29.3				
	M	88.7	30.3	99.7	2.1	100.0	0.0
Stop Bleeding	P	73.2	26.9				
	M	69.3	29.1	97.6	7.5	99.4	3.9
Treat for Shock	P	84.6	27.8				
	M	87.2	23.2	98.0	8.0	100.0	0.0
Splint Fracture	P	52.0*	38.3				
	M	44.8	35.7	98.3	6.4	98.0	6.0
Determine Azimuth	P	25.7	43.6				
	M	25.4	43.3	100.0	0.0	100.0	0.0
Back Azimuth	P	50.0	50.3				
	M	47.5	49.3	100.0	0.0	100.0	0.0
Convert Azimuth	P	32.1	47.0				
	M	29.6	46.0	100.0	0.0	100.0	0.0

*Difference between means significant at .05 level.

Table 11
Mean Time to Perform Tasks on Acquisition Test by Training Condition

Task		1st Trial Acquisition		2nd Trial Acquisition		3rd Trial Acquisition	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Install Radio	P	119.7	38.2				
	M	109.8	35.8	78.4	18.8	68.2	13.6
Install Telephone	P	62.4	23.7				
	M	66.3	28.7	45.7	11.7	40.4	11.7
Mount ANPVS-2 on M16A1 Rifle	P	112.2	57.6				
	M	104.6	55.7	76.7	23.7	64.4	19.1
Load M16	P	8.3	2.5				
	M	8.3	3.4	7.0	1.9	6.8	2.0
Reduce Stoppage M16	P	8.7	2.7				
	M	8.7	2.5	7.7	1.9	7.0	1.7
Clear M16	P	8.3	2.0				
	M	8.2	2.0	7.7	2.0	7.0	1.9
Clear M203 Grenade Launcher	P	4.0	2.3				
	M	3.9	2.2	2.7	1.4	2.5	1.5
Load M203	P	4.8	2.1				
	M	4.5	1.9	3.9	2.0	3.4	1.5
Unload M203	P	3.2	1.8				
	M	2.8	1.3	2.5	1.4	2.2	1.4
Disassemble M203	P	42.7	26.3				
	M	37.4	18.8	30.0	15.2	27.4	16.0
Assemble M203	P	37.9	22.3				
	M	38.0	20.2	29.1	14.8	27.6	18.4
Function Check M203	P	10.0	5.1				
	M	12.2	8.8	10.0	8.3	8.3	5.8
Battlesight Zero M16	P	82.8	36.5				
	M	80.2	38.2	67.7	23.1	61.4	22.0
Prepare Dragon	P	89.6	23.6				
	M	88.4	29.4	71.3	21.3	59.7	18.7
Stop Bleeding	P	81.5	18.7				
	M	83.1	20.0	64.0	21.0	56.4	23.2
Treat for Shock	P	78.8	15.0				
	M	81.9	19.0	64.1	16.2	54.5	12.7
Splint Fracture	P	244.8	51.3				
	M	251.6	56.2	191.8	37.0	172.3	37.9
Determine Azimuth	P	67.3	38.1				
	M	59.1	43.1	37.3	26.4	35.8	24.3
Back Azimuth	P	28.6	19.0				
	M	29.1	18.9	23.3	15.9	22.0	12.9
Convert Azimuth	P	34.4	34.1				
	M	30.1	24.3	20.7	20.4	18.7	15.5

In contrast, time to perform all tasks continued to decrease across all three repetitions, as shown in Table 11. Although not evaluated statistically, improvement between the first trial of acquisition and the first trial of the second repetition was dramatic: on the average, there was approximately a 25% decrease in performance time across tasks. Improvement between the second and third repetitions was approximately 8% across tasks. Although there are no data, we suspect that had additional repetitions been administered, performance time would have continued to decrease; the most likely candidate tasks for continued improvement are those with large standard deviations on the third repetition (e.g., the three map tasks).

We compared the first trial performance of the Mastery soldiers and Proficiency soldiers to determine whether there were any performance differences between the two groups prior to administering extra training to the Mastery group. We wanted to be sure that any observed differences in subsequent retention performance occurred because of the training administered during Acquisition and not because the groups differed before Acquisition training. Tasks for which the soldiers in the two training conditions differed significantly ($p < .05$) are starred in Tables 9-11. Because of these differences, we conducted parallel analyses of retention data: in addition to "standard" analyses of variance, we also used first trial Acquisition performance measures as covariates in some analyses.

Summary of Acquisition performance. As revealed by the first trial Acquisition scores, soldiers came to this phase of the field test with differing degrees of skill on our set of tasks. Some tasks (e.g., Load, Unload, and Assemble M203 Grenade Launcher) could be correctly performed by practically everyone, while other tasks (e.g., vehicle identification) could be correctly performed by very few soldiers. There were large differences in frequency and recency of task performance prior to Acquisition. Performance on all tasks improved substantially with training: accuracy approached 100% for the Mastery group by the second repetition, while performance time continued to decrease during the third repetition.

To avoid confusion, keep in mind that all soldiers performed all tasks with no errors before they were dismissed. Soldiers in the Proficiency group were trained and tested until they correctly performed the task once; soldiers in the Mastery group repeated the test-train-test cycle as many times as was necessary until they had correctly performed each task three times. Thus, by the end of the Acquisition phase, Mastery soldiers had performed each task correctly on three different occasions; many of them received additional training after their first (or second) errorless performance. The "learning" data reported in Tables 9-11 are only for the first test of each repetition. (Unfortunately, we could not

feasibly collect time data for the last Acquisition trial for either group. Thus, the Proficiency times in Table 11 do not reflect how fast these soldiers were at the end of Acquisition.)

We will postpone a discussion of the correlates of first-trial Acquisition performance (e.g., soldier ability and previous practice) until a later section of this chapter.

Retention

To repeat, the goals of this data collection activity were:

- to empirically establish the acquisition, retention, and relearning functions for a wide variety of Infantry tasks;
- to continue the exploration of the effects of soldier abilities, level of initial learning, task characteristics, and retention interval on retention; and
- to provide criterion data for the assessment of the validity of the TCS.

In this section, we will first present a global description of retention performance. Following, we will present results pertaining to the effects of the various experimental factors.

Global performance description: Accuracy. To give the reader an overall picture of retention performance, descriptive statistics for soldiers' two-, four-, and six-month performance on the two accuracy measures are shown in Tables 12 (Percentage of soldiers "GO") and 13 (Percentage of steps "GO"). Note that these Tables combine data from the Proficiency and Mastery training groups; furthermore, the four- and six-month data include some soldiers who had been retested previously, as well as soldiers who had not. Descriptive data for these subgroups will be presented where appropriate.

It is evident from these Tables that all tasks showed forgetting after two months: since (by design) all soldiers performed all tasks correctly on their last Acquisition test, any score less than perfect performance is an indication of retention loss.

Retention losses for mental tasks were dramatic. During the two-month test, no soldier could correctly name vehicles, and very few could identify vehicles as friend or foe.

Table 12
Retention Performance All Soldiers
Percentage of Soldiers "GO"

Task	2-month	4-month	6-month
Visual Signals	26.4	19.0	70.2
SALUTE	71.7	86.1	85.8
Install Radio	88.7	89.7	86.9
Enter Net	52.8	89.7	98.4
Transmit Message	7.5	26.9	59.2
Vehicle ID: Friend Foe	13.2	34.2	66.1
Vehicle ID: Nomenclature	0.0	2.5	39.7
Install Telephone	98.1	100.0	100.0
Mount ANPVS-2 on M16A1 Rifle	71.7	59.5	94.7
Identify Grenades	9.4	1.3	61.2
Load M16	73.6	78.5	79.5
Reduce Stoppage M16	73.6	81.0	91.8
Clear M16	66.0	97.5	95.0
Clear M203 Grenade Launcher	84.9	100.0	95.8
Load M203	94.3	100.0	100.0
Unload M203	96.2	100.0	100.0
Disassemble M203	18.9	34.2	95.8
Assemble M203	86.8	98.7	98.3
Function Check M203	28.3	63.3	79.1
Battlesight Zero M16	75.5	67.1	99.2
Prepare Dragon	28.3	21.8	75.4
Stop Bleeding	56.6	53.2	48.8
Treat for Shock	90.6	69.7	79.3
Splint Fracture	64.2	46.2	49.6
Determine Azimuth	45.3	39.2	92.6
Back Azimuth	56.6	63.3	86.9
Convert Azimuth	43.4	36.7	90.2

Table 13
Retention Performance All Soldiers
Percentage of Steps "GO"

Task	2-month		4-month		6-month	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Visual Signals	78.8	19.5	69.5	23.7	94.6	10.9
SALUTE	95.3	5.1	95.8	14.0	97.6	5.8
install Radio	98.5	4.6	97.6	9.0	97.0	9.1
Enter Net	86.8	18.4	93.1	23.2	99.7	2.6
Transmit Message	76.7	14.7	76.8	23.3	86.6	19.4
Vehicle ID: Friend Foe	79.1	15.4	87.0	14.2	93.0	13.3
Vehicle ID: Nomenclature	35.1	27.1	41.8	28.7	70.7	30.0
Install Telephone	99.5	4.6	100.0	0.0	100.0	0.0
Mount ANPVS-2 on M16A1 Rifle	92.2	17.2	82.7	28.9	94.7	13.2
Identify Grenades	74.7	16.4	68.6	15.6	91.3	15.2
Load M16	95.1	9.3	96.4	7.4	97.0	6.2
Reduce Stoppage M16	94.7	9.7	95.4	11.0	98.2	6.4
Clear M16	94.0	8.7	99.6	2.6	99.2	3.6
Clear M203 Grenade Launcher	98.4	5.9	100.0	0.0	99.6	3.3
Load M203	98.9	4.7	100.0	0.0	100.0	0.0
Unload M203	98.7	6.4	100.0	0.0	100.0	0.0
Disassemble M203	75.5	11.2	80.5	20.5	98.0	12.1
Assemble M203	96.2	10.3	99.7	2.8	99.5	3.2
Function Check M203	84.3	15.8	90.1	16.3	96.3	8.4
Battlesight Zero M16	90.6	18.5	89.3	16.8	99.6	4.5
Prepare Dragon	86.9	12.3	79.3	20.6	94.4	12.8
Stop Bleeding	84.9	20.4	78.9	28.4	74.8	31.2
Treat for Shock	96.9	9.8	89.9	15.4	93.1	13.6
Solint Fracture	88.7	17.8	82.8	20.8	83.3	21.5
Determine Azimuth	71.9	36.1	64.0	40.3	95.8	18.2
Back Azimuth	73.1	35.7	74.1	40.1	95.1	13.5
Convert Azimuth	60.9	42.5	51.4	45.5	96.1	13.6

Similarly, performance was relatively poor on "Transmit Message" and "Identify Grenades." On the other hand, performance was quite good on some physical tasks, such as "Install Telephone" and "Load and Unload the M203." On these tasks, soldiers' performance did not decline noticeably. However, since soldiers' performance for these tasks on the first trial of Acquisition was almost perfect, it is not surprising that their performance did not decline after two months.

For most of the mental tasks, performance declined between the two-month and four-month tests, while for most physical tasks, performance remained about the same between the two tests. However, for the tasks "SALUTE," "Enter the Net," "Transmit Radio Message," "ID Vehicles: Friend-Foe," and "Disassemble M203" performance improved. This may have occurred because data for soldiers tested at the two-month retention interval were included in these statistics. Some intervening training also may have occurred after the two-month test. In addition, soldiers tested at two months could have practiced the tasks in an attempt to improve their performance during the 4-month test.

The descriptive statistics for the six-month retention test show a dramatic increase in proficiency on practically all tasks when compared to the two- and four-month retention scores. Since it was clear that these data did not reflect forgetting, we elected not to conduct any detailed analyses of them. Rather, we investigated possible causes for the increased proficiency.

After completing the Retention phase, we reviewed the training activities of the two companies who supplied most of the soldiers for the six-month test. We reviewed the training schedule for training events during the period that might have had refresher benefits. We also interviewed the training officer in each company to identify factors that may have increased performance.

We found that many (if not most) of the soldiers had undergone periods of collective and individual training at some point between the four- and six-month test. Many soldiers in our sample took part in squad drills, ARTEPs, and SQT. However, we were convinced that this training could not account for the dramatic improvements; therefore, we interviewed a few scorers and actual participants in the study.

Unfortunately, we could not determine the one specific cause for the performance improvements. The most probable explanation is that there was inadequate scorer training prior to the six-month test. Due to certain company events, the scorers used during the previous tests were unavailable for the six-month test; thus, we were forced to train new scorers. Furthermore, the six-month test included the nine

additional SQT tasks; we had to spend most of our time preparing the new scorers for these new tests. It is our current hypothesis that these scorers, who were not familiar with our rigorous approach to step-by-step scoring, adopted more lenient and broader (i.e., task-level) scoring criteria.

A summary description of accuracy over time is shown in Table 14. The 27 tasks were rank-ordered on the basis of percentage of soldiers "GO" for each phase of testing. Despite some substantial changes in performance, tasks tended to maintain their order of difficulty. Between-phase correlations are shown below:

	2-Month	4-Month	6-Month
Acquisition	.78	.78	.69
2-Month	--	.88	.66
4-Month	--	--	.74

Thus, for example, "Vehicle ID: Nomenclature," despite a fairly dramatic improvement in performance at the 6-month test (from 2.5% to 39.7% of the soldiers performing correctly), was still the most difficult task; similarly, "Transmit Message," "Vehicle ID: Friend-Foe," "Identify Grenades," and "Visual Signals" maintained their approximate rankings across all retention intervals despite higher scores.

Performance description: Time. Since performance times decreased substantially during Acquisition for the Mastery group, it would be misleadng to combine times across groups. Thus, Table 15 presents performance times for the Mastery and Proficiency groups separately at each retention phase. For convenience, the Acquisition phase performance times are repeated: these are first-trial Acquisition times for the Proficiency group (recall that we did not collect times for their last trial), and the times for the three trials of the Mastery group.

To repeat, we do not know how rapidly tasks were performed by the Proficiency group at the end of the Acquisition phase. A reasonable approximation of their times is the Mastery group's performance on the second trial of Acquisition: recall that these times were collected following one correct trial, which would have been similar to the case had the Proficiency group's times been measured. To illustrate, consider the times in Table 15 for "Install Radio." An estimate of the Proficiency group's time at the end of Acquisition would be 78.4 sec., the mean time for the Mastery group on their second trial.

Table 14
Summary: Rank Order and Percent of Soldiers "GO"

	First Trial Acquisition		2-Month Retention		4-Month Retention		6-Month Retention	
	Rank	%	Rank	%	Rank	%	Rank	%
M16A1 Rifle								
Load	15	62.4	18.5	73.6	17.0	78.5	11.0	79.5
Reduce Stoppage	21	79.4	18.5	73.6	18.0	81.0	16.0	91.8
Clear	22	89.1	15.0	66.0	22.0	97.5	19.0	95.0
Battlesight Zero	20	75.8	20.0	75.5	15.0	67.1	24.0	99.2
Mount ANPVS-2	7	21.8	16.5	71.7	12.0	59.5	18.0	94.7
M203 Grenade Launcher								
Clear	25	96.4	21.0	84.9	25.5	100.0	20.5	95.8
Load	27	98.8	25.0	94.3	25.5	100.0	26.0	100.0
Unload	26	98.2	26.0	96.2	25.5	100.0	26.0	100.0
Disassemble	13	50.9	5.0	18.9	6.5	34.2	20.5	95.8
Assemble	24	97.0	22.0	86.8	23.0	98.7	22.0	98.3
Function Check	16	67.9	7.5	28.3	13.5	63.3	9.0	79.1
Radio								
Install	18	72.1	23.0	88.7	20.5	89.7	13.5	86.9
Enter Net	6	17.6	11.0	52.8	20.5	89.7	23.0	98.4
Transmit Message	2	4.2	2.0	7.5	5.0	26.9	4.0	59.2
Equipment								
Install Telephone	23	94.5	27.0	98.1	25.5	100.0	26.0	100.0
Prepare Dragon	19	75.2	7.5	28.3	4.0	21.8	8.0	75.4
Identify Grenades	5	16.4	3.0	9.4	1.0	1.3	5.0	61.2
First Aid								
Stop Bleeding	10	32.7	12.5	56.6	11.0	53.2	2.0	48.8
Treat for Shock	17	69.7	24.0	90.6	16.0	69.7	10.0	79.3
Splint Fracture	4	12.1	14.0	64.2	10.0	46.2	3.0	49.6
Maps								
Determine Azimuth	8	24.2	10.0	45.3	9.0	39.2	17.0	92.6
Back Azimuth	12	47.9	12.5	56.6	13.5	63.3	13.5	86.9
Convert Azimuth	9	30.9	9.0	43.4	8.0	36.7	15.0	90.2
Vehicle Identification								
Friend-Foe	3	5.5	4.0	13.2	6.5	34.2	6.0	66.1
Nomenclature	1	0.0	1.0	0.0	2.0	2.5	1.0	39.7
Visual Signals	11	44.2	6.0	26.4	3.0	19.0	7.0	70.2
SALUTE	14	54.5	16.5	71.7	19.0	86.1	12.0	85.8

Table 15
Retention Performance All Soldiers
Performance Time (Seconds)

Task		Acquisition 1	Acquisition 2	Acquisition 3	2-month Mean	2-month Standard Deviation	4-month Mean	4-month Standard Deviation	6-month Mean	6-month Standard Deviation
Install Radio	P	119.7			109.3	*24.8*	124.8	*27.0*	103.7	*24.4*
	M	109.8	78.4	68.2	101.4	*18.5*	114.5	*20.2*	101.9	*27.5*
Install Telephone	P	62.4			82.5	*32.0*	50.3	*17.1*	75.6	*21.6*
	M	66.3	45.7	40.4	79.4	*26.7*	48.3	*15.8*	68.0	*19.5*
Mount ANPVS-2 on M16A1 Rifle	P	112.2			133.4	*61.2*	173.9	*77.6*	119.2	*43.6*
	M	104.6	76.7	64.4	158.7	*58.8*	168.9	*74.6*	113.0	*46.6*
Load M16	P	8.3			8.3	*2.5*	6.7	*1.6*	7.4	*1.4*
	M	8.3	7.0	6.8	8.2	*2.5*	7.1	*2.2*	6.9	*1.7*
Reduce Stoppage M16	P	8.7			9.2	*3.4*	8.0	*3.4*	7.8	*1.6*
	M	8.7	7.7	7.0	7.6	*1.8*	7.2	*1.7*	7.5	*1.4*
Clear M16	P	8.3			8.7	*2.5*	7.2	*1.5*	7.8	*1.3*
	M	8.2	7.7	7.0	8.0	*2.0*	7.4	*2.0*	7.6	*1.5*
Clear M203 Grenade Launcher	P	4.0			3.2	*1.1*	2.3	*1.6*	2.4	*1.5*
	M	3.9	2.7	2.5	3.1	*1.4*	2.0	*1.2*	2.5	*2.0*
Load M203	P	4.8			3.7	*1.2*	3.8	*1.6*	4.2	*2.0*
	M	4.5	3.9	3.4	4.6	*1.7*	4.0	*1.6*	4.0	*1.6*
Unload M203	P	3.2			2.3	*1.0*	2.1	*1.2*	2.0	*1.1*
	M	2.8	2.5	2.2	2.6	*1.5*	2.0	*1.0*	2.1	*1.3*
Disassemble M203	P	42.7			49.8	*33.5*	52.7	*28.7*	39.2	*23.0*
	M	37.4	30.0	27.4	53.6	*33.1*	54.8	*27.4*	36.0	*20.7*
Assemble M203	P	37.9			44.0	*20.0*	49.8	*24.4*	29.5	*14.6*
	M	38.0	29.1	27.6	55.6	*39.7*	51.6	*26.9*	30.1	*13.8*
Function Check M203	P	10.0			13.4	*14.2*	12.0	*6.9*	12.3	*7.0*
	M	12.2	10.0	8.3	16.2	*15.0*	13.1	*7.9*	11.6	*5.4*
Battlesight Zero M16	P	82.8			134.0	*46.9*	89.2	*32.1*	91.4	*31.1*
	M	80.2	67.7	61.4	123.7	*47.9*	81.5	*18.2*	93.2	*32.1*
Prepare Dragon	P	89.6			106.7	*30.2*	86.7	*21.4*	78.5	*26.6*
	M	88.4	71.3	59.7	93.6	*32.6*	79.8	*23.5*	70.6	*26.6*
Stop Bleeding	P	81.5			70.8	*23.1*	79.6	*18.8*	73.6	*23.1*
	M	83.1	64.0	56.4	66.0	*18.9*	74.8	*19.9*	70.7	*22.7*
Treat for Shock	P	78.8			57.2	*22.9*	63.1	*17.3*	59.6	*18.2*
	M	81.9	64.1	54.5	65.1	*18.7*	63.2	*19.2*	58.7	*17.4*
Splint Fracture	P	244.8			217.0	*46.2*	201.4	*51.2*	192.8	*58.4*
	M	251.6	191.8	172.3	206.2	*65.1*	196.3	*42.1*	190.6	*50.7*
Determine Azimuth	P	67.3			65.0	*53.3*	43.5	*26.8*	59.0	*36.8*
	M	59.1	37.3	35.8	66.6	*52.7*	50.9	*35.8*	54.5	*41.5*
Back Azimuth	P	28.6			25.2	*19.1*	37.3	*43.2*	30.9	*18.4*
	M	29.1	23.3	22.0	28.2	*23.1*	24.0	*14.4*	28.6	*19.6*
Convert Azimuth	P	34.4			51.9	*71.1*	29.9	*15.7*	46.3	*43.6*
	M	30.1	20.7	18.7	45.3	*73.2*	31.8	*25.5*	43.2	*33.2*

Looking first at the most direct manifestation of retention loss -- the differences between the last Acquisition trial times and the two-month retention times for the Mastery group -- we find substantial and highly significant (using t-tests at the $p < .01$ level) increases in performance time for practically all tasks. The only exceptions are "Reduce Stoppage on M16," "Clear, Load, and Unload the M203," "Back Azimuth," and "Clear the M16"; even these tasks show large increases. It even appears that times for some tasks "regressed" to levels slower than first-trial Acquisition times (e.g., "Mount ANPVS-2"). These comparisons, however, should be viewed cautiously: first-trial Acquisition times might have been faster than expected because many steps may have been omitted; furthermore, note the substantial variability of all the time scores. In fact, the distributions are all highly skewed towards the high end (i.e., there were some extremely long times and very few, if any, extremely short times); thus, the means may be an inflated estimate of group performance.

As was mentioned above, there are no direct reflections of retention loss for the Proficiency groups; however, if we compare the second trial of the Mastery group with the times of the Proficiency group, we see approximately the same pattern of loss as we saw for the Mastery group: most tasks show large increases in time over two months.

Beyond two months, the pattern of results is inconsistent across tasks. Some tasks show continued retention loss at four months (e.g., "Install Radio" and "Mount ANPVS-2"), while other tasks show decreases in time at either four months, six months, or both. These inconsistencies, plus the high variability of the times, make these retention scores difficult to interpret.

Training effects: Mastery vs. Proficiency. We performed analyses of variance and analyses of covariance to compare the retention performance of soldiers in the two training conditions to see whether additional training on a task would improve retention. Table 16 shows the mean retention performance for the Proficiency and Mastery groups.

For the two-month data, we first conducted analyses of covariance to statistically control for group differences on the first trial of Acquisition. Tasks for which soldiers in the training conditions differed significantly (using an F-test and a $p < .05$) are starred.

Examining the accuracy measures first, we see that the two groups differed significantly on only five tasks. The Mastery group performed better than the Proficiency group on "Visual Signals" and "Enter the Net" for both measures. The Mastery group also performed better than the Proficiency group on the tasks "Transmit Message," "Disassemble M203,"

Table 16
Two Month Retention Performance
Means by Condition

Task		Mean % Steps "GO"	% Soldiers "GO"	Mean Time
Visual Signals	P	73.0*	13.3*	Not Timed
	M	86.5	43.5	
SALUTE	P	93.5	61.3	Not Timed
	M	97.7	86.4	
Install Radio	P	97.9	85.7	109.3
	M	99.2	92.0	101.4
Enter Net	P	80.7*	32.1*	Not Timed
	M	93.6	76.0	
Transmit Message	P	73.0	0.0*	Not Timed
	M	80.9	16.0	
Install Telephone	P	98.8	96.4	82.5
	M	100.0	100.0	79.4
Mount ANPVS-2 on M16A1 Rifle	P	90.1	75.0	133.4
	M	94.7	68.0	158.7
Identify Grenades	P	75.0	10.7	Not Timed
	M	74.3	8.0	
Vehicle ID: Friend Foe	P	79.2	12.0	Not Timed
	M	78.9	14.3	
Vehicle ID: Nomenclature	P	28.8	0.0	Not Timed
	M	40.7	0.0	
Battlesight Zero M16	P	91.0	76.0	134.0
	M	90.2	75.0	123.7
Load M16	P	94.3	68.0	8.3
	M	95.9	78.6	8.2
Reduce Stoppage M16	P	94.7	68.0	9.2
	M	94.6	78.6	7.6
Clear M16	P	94.7	64.0	8.7
	M	94.6	67.9	8.0
Clear M203 Grenade Launcher	P	98.1	88.5	3.2
	M	98.8	81.5	3.1
Load M203	P	100.0	100.0	3.7*
	M	97.8	88.9	4.6
Unload M203	P	100.0	100.0	2.3
	M	97.5	92.6	2.6
Disassemble M203	P	69.2*	11.5	49.8
	M	81.5	25.9	53.6
Assemble M203	P	98.1	88.5	44.0
	M	95.4	85.2	55.6

Table 16 (continued)

Task		Mean % Steps "GO"	% Soldiers "GO"	Mean Time
Function Check M203	P	82.7	26.9	13.4
	M	85.9	29.6	16.2
Prepare Dragon	P	86.3	20.0	106.7
	M	87.5	35.7	93.6
Splint Fracture	P	87.2	64.0	217.0
	M	90.0	64.3	206.2
Stop Bleeding	P	79.0*	44.0	70.8
	M	90.2	67.9	66.0
Treat for Shock	P	96.0	88.0	57.2
	M	97.6	92.9	65.1
Determine Azimuth	P	70.4	42.9	65.0
	M	73.7	48.0	66.6
Back Azimuth	P	76.8	60.7	25.2
	M	69.0	52.0	28.2
Convert Azimuth	P	62.9	42.9	51.9
	M	58.5	44.0	45.3

* Difference between means significant at .05 level.

and "Stop Bleeding." For the task "Transmit Message," the Mastery group had a significantly higher percentage of soldiers "GO" on the task. On the tasks "Disassemble M203" and "Stop Bleeding," Mastery soldiers had a significantly higher mean percentage of steps correct. However, the percentage of soldiers "GO" did not differ between training conditions on either of these two tasks.

We repeated the comparison of Mastery and Proficiency differences using unadjusted scores. The results were practically identical: all of the differences reported above were also significant using unadjusted scores. In addition, differences were significant for both accuracy measures on the "SALUTE" task and for mean percentage of steps correct on the "Transmit Message" task.

Despite the lack of overwhelming statistical support for a Mastery-Proficiency difference, the overall pattern of results for the accuracy measures indicate the potential benefits of Mastery training at the two-month interval. Most of the tasks on both measures favored the Mastery group (20/27 on Percentage of steps "GO," and 18/27 for Percentage of soldiers "GO"); less conservative statistical techniques might reinforce this tendency.

At the four-month interval, the analysis of group differences is complicated by the fact that some soldiers had been tested at two months. Since this "treatment" may have interacted with the Mastery-Proficiency treatment, we conducted an analysis of covariance, where the factors were the experimental condition (Mastery or Proficiency) and previous testing (2-month and 4-month or 4-month only). As before, we conducted parallel analyses of variance and covariance; in the latter, first-trial Acquisition performance differences between groups were covaried. Table 17 shows unadjusted means for each task.

Again, both analyses produced virtually identical results. Looking first at the Mastery-Proficiency effects, only a few differences in the performance of soldiers in the two training conditions were observed at the four-month interval. On tasks where differences occurred, the Mastery soldiers were usually better than the Proficiency soldiers. For example, a higher proportion of Mastery soldiers were "GO" on the task "Function Check M203" than Proficiency soldiers. Mastery soldiers had a higher percentage of steps "GO" on "Treat for Shock" than Proficiency soldiers. However, on one task, Proficiency soldiers performed better than Mastery soldiers. A higher percentage of Proficiency soldiers were "GO" on "Battlesight Zero M16A1," and Proficiency soldiers performed a higher percentage of steps correctly. Again, the overall impression is that the benefits of Mastery training that appeared at the two-month interval had dissipated by four months.

Table 17
Four Month Retention Means by Condition and Whether or Not Previously Tested

Task		Mean % Steps "GO"		% Soldiers "GO"		Mean Time	
		Tested At 2 Months	Not Tested At 2 Months	Tested At 2 Months	Not Tested At 2 Months	Tested At 2 Months	Not Tested At 2 Months
Visual Signals	P	76.4	59.4△	20.0	15.0		
	M	81.9	55.6	36.8	0.0	Not Timed	
SALUTE	P	99.4	89.2	96.1	75.0□		
	M	95.4	98.9	77.8	93.3	Not Timed	
Install Radio	P	98.2	97.0	90.9	95.0	118.2	131.7
	M	96.7	98.7	85.7	86.7	115.8	112.7
Enter Net	P	99.1	82.0△	95.4	75.0△		
	M	100.0	89.3	100.0	86.7	Not Timed	
Transmit Message	P	80.1	73.3	27.3	30.0		
	M	79.9	71.1	33.3	13.3	Not Timed	
Vehicle ID: Friend Foe	P	88.1	84.7	33.3	26.7		
	M	90.4	83.5	39.1	35.0	Not Timed	
Vehicle ID: Nomenclature	P	45.7	33.3△	0.0	6.7		
	M	51.3	33.0	0.0	5.0	Not Timed	
Telephone	P	100.0	100.0	100.0	100.0	49.3	51.3
	M	100.0	100.0	100.0	100.0	49.3	46.9
Mount ANPVS-2 on M16A1 Rifle	P	86.5	79.4△	60.8	50.0△	163.9	185.4
	M	93.7	65.9	80.9	40.0	169.0	168.7
Identify Grenades	P	72.8	62.8△	0.0	4.2		
	M	70.6	68.2	0.0	0.0	Not Timed	
Battlesight Zero M16	P	94.0	93.3*	85.7	73.3*	84.2	95.6
	M	89.1	81.2	60.9	50.0	81.4	81.6
Load M16	P	96.6	97.1	80.9	80.0	6.8	6.5
	M	94.4	97.9	69.6	85.0	6.7	7.7
Reduce Stoppage M16	P	93.7	97.8	76.2	86.7	8.6	7.1□
	M	94.2	96.7	78.3	85.0	6.7	7.8
Clear M16	P	99.2	100.0	95.2	100.0	7.7	6.6□
	M	100.0	99.2	100.0	95.0	7.0	7.9
Clear M203 Grenade Launcher	P	100.0	100.0	100.0	100.0	2.0	2.7
	M	100.0	100.0	100.0	100.0	2.1	1.9
Load M203	P	100.0	100.0	100.0	100.0	3.8	3.9
	M	100.0	100.0	100.0	100.0	3.9	4.2
Unload M203	P	100.0	100.0	100.0	100.0	2.1	2.2
	M	100.0	100.0	100.0	100.0	2.0	1.9
Disassemble M203	P	81.8	73.3	22.7	27.8	43.2	64 4△
	M	84.5	81.2	45.4	41.2	49.9	61.1
Assemble M203	P	100.0	98.6	100.0	94.4	43.7	57.2
	M	100.0	100.0	100.0	100.0	49.7	54.1

Table 17 (continued)

Task		Mean % Steps "GO"		% Soldiers "GO"		Mean Time	
		Tested At 2 Months	Not Tested At 2 Months	Tested At 2 Months	Not Tested At 2 Months	Tested At 2 Months	Not Tested At 2 Months
Function Check M203	P	82.3	93.3△	36.4	72.2△*	9.5	14.9△
	M	88.6	98.8	63.6	88.2	11.2	15.5
Prepare Dragon	P	84.1	76.0	33.3	17.6	84.9	88.9
	M	81.8	73.6	13.6	22.2	76.3	84.1
Stop Bleeding	P	66.7	78.6△	38.1	57.1△	78.1	81.8
	M	84.7	85.5	52.2	68.4	72.3	77.7
Treat for Shock	P	92.1	85.7*	76.2	57.1	61.7	65.4
	M	90.9	89.5	72.7	68.4	60.7	66.1
Splint Fracture	P	86.7	73.3	57.1	33.3	192.6	213.7
	M	87.8	80.0	56.5	31.6	198.3	193.9
Determine Azimuth	P	74.5	50.0	52.2	25.0	36.5	51.6
	M	66.0	63.8	33.3	46.7	51.1	50.7
Back Azimuth	P	85.9	46.2□	69.6	40.0	31.2	44.5
	M	80.9	83.3	66.7	80.0	23.5	24.7
Convert Azimuth	P	56.5	31.9△	39.1	20.0△	28.7	31.1
	M	70.2	43.3	61.9	20.0	29.8	34.8

* Main effect of training condition significant at $p < .05$

△ Main effect of previous testing significant at $p < .05$

□ Training condition—previous testing interaction significant at $p < .05$

Effects of previous testing. The analyses of variance and covariance for the four-month results showed that, for some of the tasks, there was a significant effect of previous testing or a significant interaction between testing and training condition. Soldiers tested at two months and four months performed significantly better ($p < .05$) than soldiers tested only at four months for some of the mental tasks. For example, a higher percentage of soldiers tested at both two months and four months were "GO" and performed a higher percentage of steps correctly than soldiers tested only at four months for the tasks "Visual Signals," "Enter the Net," and "Splint."

Previous testing interacted with training condition for the "SALUTE" and "Back Azimuth" tasks. The interaction was significant for percentage of soldiers "GO" on the SALUTE task and on percentage of steps "GO" for the "Back Azimuth" task.

Soldier Abilities. We conducted an analysis to assess whether individual abilities of soldiers, as measured by the ASVAB, were related to performance. Tables 18-20 show the correlations between the AFQT and the ASVAB area composite scores and the first-trial Acquisition performance measures for each task. (The AFQT score and each of the Aptitude Area Composite scores are combinations of ASVAB subtest scores. For example, in the most recent version on the ASVAB,

AFQT = Word Knowledge + Paragraph Comprehension + Arithmetic Reasoning + Numerical Operations/2

After the AFQT "raw score" is computed, the result is transformed (nonlinearly) to generate the soldier's final AFQT score.)

As can be seen in these Tables, there were no systematic relationships between a single composite score or a set of composite scores and a large number of tasks. Rather, for some of the tasks, any of the composite scores seemed to correlate with performance fairly well, while for other tasks, performance was not related at all. For example, the three Map tasks had significant correlations with all of the ASVAB scores; "Treat for Shock" and "Splint Fracture" did not correlate with any ASVAB score. Furthermore, we could not detect any commonalities among the tasks (and measures) that were or were not correlated.

Correlations were also generated for the two-month and four-month retention data. The results were similar: there were many significant correlations, but no systematic patterns were apparent.

These results suggest that although soldiers' individual differences do not seem to systematically correlate with

Table 18
Correlations[1] Between ASVAB Scores and GO/NO GO on First Trial of Acquisition

Task	AFQT	CO	FA	EL	OF	SC	MM	GM	CL	ST	GT
Visual Signals	– 25*	24*	28*	18	25*	21*	24*	21*	20*	17	19
SALUTE	14	21*	20	15	22*	23*	15	13	11	16	12
Install Radio	8	15	– 1	3	21	24*	19	7	3	11	9
Enter Net	14	15	7	13	15	23	14	13	11	19	10
Transmit Message	16	11	– 1	2	– 1	21	– 16	– 12	8	– 3	18
Vehicle ID: Friend Foe	– 32*	– 14	– 23	– 30	– 30	– 36*	– 34*	– 34*	– 24	– 38*	– 36*
Vehicle ID: Nomenclature	All NO GO — No variance										
Telephone	0	7	– 1	– 3	8	– 12	– 4	– 3	– 21	6	1
Mount ANPVS-2 on M16A1 Rifle	17	8	5	10	– 4	10	3	9	11	8	15
Identify Grenades	34*	29*	19	21	31*	30*	30*	22	35*	25*	20
Load M16	8	24*	12	22*	25*	15	23*	33*	10	19	5
Reduce Stoppage M16	0	6	10	7	5	– 4	6	10	– 5	7	– 2
Clear M16	– 3	0	0	12	– 2	– 2	0	2	– 9	3	13
Clear M203 Grenade Launcher	35	38	30	55*	40	37	46*	49*	20	51*	18
Load M203	19	15	– 9	35	31	– 2	28	47	– 45	39	– 39
Unload M203	29	22	48	8	14	26	8	– 7	41	5	16
Disassemble M203	21*	19	15	17	25*	19	25*	23*	19	25*	9
Assemble M203	4	– 11	8	17	– 15	– 7	– 20	– 7	8	9	4
Function Check M203	0	7	5	– 1	4	6	0	2	9	9	4
Battlesight Zero M16	21	27*	27*	13	24*	23*	29*	25*	22*	8	22*
Prepare Dragon	– 13	– 21	18	– 15	– 28*	– 23*	– 27*	– 19	– 19	– 19	4
Stop Bleeding	12	12	9	19	14	8	11	15	9	17	12
Treat for Shock	– 4	– 3	– 6	0	– 2	0	– 5	– 6	– 2	1	3
Splint Fracture	– 2	16	4	4	11	14	7	9	0	2	– 2
Determine Azimuth	23*	24*	22	36*	20	25*	19	26*	19	29*	32*
Back Azimuth	42*	36*	41*	43*	35*	31*	30*	41*	32*	36*	43*
Convert Azimuth	30*	27*	22*	35*	29*	25*	24*	34*	19	35*	29*

[1]Biserial correlations rounded to nearest hundredth, decimals are omitted

*Significant at .05 level

Table 19
Correlations[1] between ASVAB Scores and % of Steps "GO" on First Trial of Acquisition

Task	AFQT	CO	FA	EL	OF	SC	MM	GM	CL	ST	GT
Visual Signals	11	11	15	5	14	10	12	12	9	5	9
SALUTE	16*	16	17*	20*	25*	21*	18*	22*	8	22*	11
Install Radio	13	20*	9	10	21*	24*	21*	14	17*	15	11
Enter Net	5	10	6	6	7	11	8	8	7	10	6
Transmit Message	9	5	12	1	7	1	14	5	1	6	2
Vehicle ID: Friend Foe	16	21*	15	15	17*	13	14	16	7	16	15
Vehicle ID: Nomenclature	1	2	3	2	1	0	3	2	3	2	4
Install Telephone	0	3	1	1	4	6*	2	1	10	3	0
Mount ANPVS-2 on M16A1 Rifle	9	4	2	6	2	5	3	6	2	5	8
Identify Grenades	22*	30*	18*	28*	31*	24*	32*	27*	22*	35*	15
Load M16	6	21*	15	14	19*	12	18*	26*	8	15	5
Reduce Stoppage M16	1	0	4	1	3	2	2	2	3	6	0
Clear M16	5	3	5	9	4	2	3	9	2	3	10
Clear M203 Grenade Launcher	16*	16	12	21*	19*	18*	20*	20*	11	22*	8
Load M203	4	3	2	8	7	0	6	10	10	9	9
Unload M203	8	6	14	2	4	8	2	2	12	1	5
Disassemble M203	15	11	9	13	17*	13	17*	17*	12	18*	9
Assemble M203	7	1	7	2	2	1	4	3	6	3	5
Function Check M203	0	5	2	1	4	5	1	2	8	7	3
Battlesight Zero M16	18*	21*	20*	15	17*	18*	23*	21*	17*	12	20*
Prepare Dragon	5	15	10	12	17*	16	16	14	12	14	5
Stop Bleeding	2	6	1	9	7	3	6	7	3	7	8
Treat for Shock	1	0	3	2	1	3	1	1	1	3	7
Splint Fracture	4	15	5	8	15	13	13	14	7	5	15
Determine Azimuth	17*	17*	15*	27*	14	18*	14	20*	12	21*	24*
Back Azimuth	32*	28*	30*	35*	27*	24*	24*	33*	24*	29*	33*
Convert Azimuth	23*	21*	17*	26*	22*	19*	19*	26*	15	27*	22*

[1]Pearson product-moment correlations, rounded to nearest hundredth, decimals are omitted

*Significant at .05 level

Table 20
Correlations[1] Between ASVAB Scores and Time on First Trial of Acquisition

Task	AFQT	CO	FA	EL	OF	SC	MM	GM	CL	ST	GT
Visual Signals											
SALUTE											
Install Radio	−16*	−30*	−20*	−22*	−31*	−31*	−34*	−27*	−27*	−22*	−10
Enter Net											
Transmit Message											
Vehicle ID: Friend Foe											
Vehicle ID: Nomenclature											
Install Telephone	−24*	−28*	−20*	−20*	−25*	−27*	−28*	−18*	−26*	−24*	−15
Mount ANPVS-2 on M16A1 Rifle	3	− 9	− 6	0	− 5	− 1	− 9	− 4	− 4	− 1	− 2
Identify Grenades											
Load M16	− 7	− 8	−12	−10	− 8	−11	−11	−14	− 6	− 1	−15
Reduce Stoppage M16	− 4	− 4	− 4	−14	− 2	− 1	− 9	−14	1	− 2	−16
Clear M16	− 9	− 8	− 5	−13	− 9	− 7	−12	−14	−11	− 4	−12
Clear M203 Grenade Launcher	1	− 8	− 6	− 3	− 8	− 2	−13	−14	5	−11	− 6
Load M203	− 8	−10	−12	−10	− 8	− 6	−16	−18*	0	−11	− 8
Unload M203	− 8	− 9	−17*	− 6	− 9	− 7	− 9	− 8	−14	− 8	− 5
Disassemble M203	− 1	−15	− 6	−11	−17*	− 4	−16	−12	− 1	−10	− 2
Assemble M203	− 9	−10	− 5	−10	−14	− 7	−17*	−11	− 2	−10	− 1
Function Check M203	− 8	− 3	− 4	− 9	− 5	− 7	− 8	− 6	− 6	− 1	− 2
Battlesight Zero M16	3	5	2	0	5	16	5	3	12	2	0
Prepare Dragon	− 4	− 8	0	−11	− 6	− 3	− 7	−15	8	−12	− 0
Stop Bleeding	−10	−23*	−16	−16	−24*	−21*	−22*	−27*	−20*	−11	− 8
Treat for Shock	− 4	−10	− 7	− 3	−10	−10	−14	− 6	− 4	− 2	0
Splint Fracture	− 6	− 4	1	8	− 1	− 4	− 2	− 3	− 2	− 3	−11
Determine Azimuth	−22*	−28*	−27*	−20*	−20*	−24*	−17*	−17*	−28*	−16*	−17*
Back Azimuth	−21*	−21*	−27*	−14	−16	−13	−15	−23*	−13	−15	−18*
Convert Azimuth	−18*	−26*	−23*	−19*	−18*	−21*	−17*	−20*	−18*	−14	−10

[1]Pearson product-moment correlations, rounded to nearest hundredth, decimals are omitted

*Significant at .05 level

performance on a given task, the sheer number and magnitude of the observed correlations indicates that individual differences are important determiners of performance. Perhaps a more detailed examination of the ASVAB components and the tasks would reveal some consistencies and generalizable patterns that are presently not apparent.

Practice. Soldiers were asked if they had performed each task in the interval since their last test, and, if so, when and how frequently the task had been performed. These data are summarized in Table 21. It should be stressed that these are self-report data; we have no confirmatory information from company sources. As can be seen, the proportions of soldiers reporting that they had done each task are quite high; these proportions are lower for soldiers reporting performance during the last month.

The correlations between these recency/frequency measures and performance (percentage of soldiers "GO") are shown in Tables 22 and 23 for first-trial Acquisition, the two-month and the four-month retention tests. Despite the high proportions of soldiers performing the tasks, these correlations are surprisingly low: In only one case was more than 15% of the variance in performance accounted for by practice. Furthermore, many of the significant correlations are in the "wrong" direction: more practice was associated with poorer performance (e.g., the correlations between number of steps "GO" and Recency of practice at two months are all negative).

Since we do not know the circumstances under which these tasks were practiced, we will not speculate as to why these relationships are not stronger. Rather, we will defer further discussion until we present the results of analyses that attempted to predict performance from several factors, including practice and soldiers' abilities.

Analysis of errors on steps. We examined the errors made by soldiers at each retention test on each task. This information is useful because it allows us to determine which steps are most difficult, and thus, which steps should be emphasized during training.

Tables 24 and 25 shows the percentage of soldiers who correctly performed each step of each task for the two-month and four-month retention tests. The steps listed in the Tables correspond with those on the test forms shown in Appendix B. The steps on some tasks had to be performed in the correct order for soldiers to receive a "GO"; in the Tables, the percentage of soldiers performing the correct sequence is indicated for those tasks. Likewise, the Tables indicate the percentage of soldiers who performed tasks within the specified time standards.

Table 21
Recency and Frequency Estimates for Task Performance Prior to Retention Tests

Task	% Soldiers Reporting They Did Task At Least Once Since Last Test			% Soldiers Reporting They Did Task In the Last Month		
	2 months	4 months	6 months	2 months	4 months	6 months
Visual Signals	81.1	88.6	80.3	28.3	65.8	23.8
SALUTE	84.9	72.2	78.7	35.8	30.4	20.5
Install Radio	77.4	83.5	81.1	24.5	46.8	24.6
Transmit Message	75.5	72.2	77.0	15.1	36.7	21.3
Install Telephone	83.0	78.5	71.3	26.4	31.6	9.8
ID Vehicles	77.4	100.0	74.6	28.3	92.4	9.0
Mount ANPVS-2 on M16A1 Rifle	60.4	53.2	55.7	7.5	13.9	4.9
Identify Grenades	88.7	77.2	68.0	37.7	39.2	8.2
Load, Reduce Stoppage and Clear M16A1	88.7	88.6	86.9	45.3	41.8	36.1
Battlesight Zero M16	90.6	100.0	86.1	43.4	87.3	31.1
Prepare Dragon	73.6	74.7	67.2	13.2	25.3	11.5
Clear, Load and Unload M203 Grenade Launcher	81.1	73.4	68.9	24.5	32.9	16.4
Disassemble, Assemble and Function Check M203	73.6	68.4	65.6	22.6	27.8	18.9
Splint Fracture	75.5	70.9	68.0	9.4	32.9	8.2
Stop Bleeding	71.7	69.6	68.0	3.8	27.8	8.2
Treat for Shock	73.6	72.2	67.2	7.5	27.8	9.8
Determine Azimuth	88.7	86.1	82.0	60.4	45.6	28.7
Convert Azimuth	86.8	83.6	79.5	56.6	44.3	28.7

Table 22

Correlations[1] Between Frequency of Performing Task and Task Performance Measures

Task	Acquisition			2-Month			4-Month		
	GO/ NO GO	% of Soldiers "GO"	Time	GO/ NO GO	% of Soldiers "GO"	Time	GO/ NO GO	% of Soldiers "GO"	Time
Visual Signals	5	11	#	−11	11	#	14	2	#
SALUTE	8	10	#	15	15	#	25*	25*	#
Install Radio	8	16*	−35*	23	18	−22	11	2	−6
Enter Net	34*	29*	−9	12	14	#	8	1	#
Transmit Message	13*	28*	−9	−16	9	#	−12	−2	#
Vehicle ID: Friend Foe	1	7	#	5	2	#	−13	−3	#
Vehicle ID: Nomenclature	#	0	#	#	12	#	5	17	#
Install Telephone	18*	18*	−4	0	0	−6	#	#	0
Mount ANPVS-2 on M16A1 Rifle	12	9	−4	−6	6	−12	22*	8	−13
Identify Grenades	−1	7	#	−14	−1	#	−14	11	#
Load M16	9	13*	−4	−19	−9	6	−3	2	−16
Reduce Stoppage M16	3	4	−2	5	6	0	−4	2	−7
Clear M16	15*	24*	−16*	7	6	11	5	5	−5
Clear M203 Grenade Launcher	5	4	7	4	−2	9	#	#	4
Load M203	9	9	−6	8	8	−12	#	#	6
Unload M203	12	12	−16*	16	16	−2	#	#	−23*
Disassemble M203	34*	38*	−10	−7	2	8	15	19*	−16
Assemble M203	15*	12	−22*	−3	−6	13	6	6	−15
Function Check M203	16*	12	−15*	10	−18	2	−6	−11	−18
Battlesight Zero M16	1	0	−4	−9	−19	12	8	11	7
Prepare Dragon	6	17*	17*	−2	10	−10	11	23*	−28*
Stop Bleeding	11	10	−10	6	15	17	−2	−10	−20*
Treat for Shock	9	18*	3	12	12	26*	−6	−6	−26*
Splint Fracture	2	5	−16*	−16	−18	−14	3	15	−13
Determine Azimuth	20*	19*	−20*	28*	45*	−36*	18	24*	−23*
Back Azimuth	17*	17*	−15*	28*	33*	−26*	5	10	−4
Convert Azimuth	30*	30*	−4	30*	35*	−7*	20*	10	−28*

[1] Biserial correlations rounded to nearest hundredth, decimals are omitted

*Significant at .05 level

No correlations available

Table 23
Correlations[1] Between Recency of Performing Task and Task Performance Measures

Task	Acquisition			2-Month			4-Month		
	GO/ NO GO	% of Soldiers "GO"	Time	GO/ NO GO	% of Soldiers "GO"	Time	GO/ NO GO	% of Soldiers "GO"	Time
Visual Signals	17*	8	#	1	−12	#	6	−7	#
SALUTE	0	−5	#	1	1	#	25*	27*	#
Install Radio	5	−4	1	−2	2	9	8	−7	5
Enter Net	1	−4	−7	−7	3	#	−15	−15	#
Transmit Message	−9	−4	−8	0	8	#	−8	−22*	#
Vehicle ID: Friend Foe	−2	−13*	#	2	−9	#	−2	−11	#
Vehicle ID: Nomenclature	#	−7	#	#	3	#	−9	−3	#
Install Telephone	6	6	−15*	−11	−11	8	#	#	5
Mount ANPVS-2 on M16A1 Rifle	11	8	1	−10	6	−10	21*	13	−12
Identify Grenades	4	8	#	−7	−26*	#	−16	−7	#
Load M16	11	0	0	−1	−4	−7	19*	24*	−18
Reduce Stoppage M16	−17*	−16*	−2	−9	−7	−11	−1	8	−7
Clear M16	−3	−11	−3	−4	−7	−2	22*	22*	−9
Clear M203 Grenade Launcher	−11	−7	−8	21	21	4	#	#	5
Load M203	−10	−10	14*	2	2	−21	#	#	−12
Unload M203	5	5	−6	10	10	14	#	#	−31*
Disassemble M203	13*	14*	−3	6	5	24*	11	9	16
Assemble M203	18*	15*	−18*	5	0	21	1	1	−10
Function Check M203	14*	12	−10	25*	4	11	8	6	−8
Battlesight Zero M16	2	−2	0	−23*	−25*	9	0	0	−2
Prepare Dragon	19*	20*	−13*	6	11	−15	9	−3	−5
Stop Bleeding	0	4	−6	5	20	12	15	9	−7
Treat for Shock	5	5	−9	2	2	25*	−14	−14	−25*
Splint Fracture	−2	−1	7	−21	−27*	−11	16	18	−10
Determine Azimuth	3	0	−18*	−7	11	−21	−6	−13	−3
Back Azimuth	11	9	−6	22	22	−22	−18	−13	15
Convert Azimuth	14*	14*	2	−11	3	−21	7	−6	−19*

[1] Biserial correlations rounded to nearest hundredth, decimals are omitted

*Significant at .05 level

No correlations available

Table 24
% of Soldiers "GO" on Each Step of Each Task
2 Month Retention Test
n = 53

Task													
	Step #	1	2	3	4	5	6	7	8	9			
Visual Signals	% GO	81	60	60	70	100	81	77	81	98			
	Step #	1	2	3	4	5	6		Sequence		Time		
SALUTE	% GO	100	98	77	98	100	98		92		94		
	Step #	1	2	3	4	5	6	7	8	9	10		
Install Radio	% GO	98	100	98	100	100	100	100	100	96	94		
	Step #	12	13	14	15	16							
Enter Net	% GO	98	96	68	85	98							
	Type of Steps	Phonetic	Conventional	Procedural									
Transmit Message	% GO	55	78	97									
Vehicle ID:	Step #	1	2	3	4	5	6	7	8	9	10		
Friend Foe	% GO	91	87	79	87	57	83	79	51	98	79		
Vehicle ID:	Step #	11	12	13	14	15							
Nomenclature	% GO	43	40	30	25	38							
	Step #	1	2	3									
Install Telephone	% GO	100	100	98									
Mount ANPVS-2	Step #	1	2	3	4	5	6	7	8	9			
on M16A1 Rifle	% GO	94	83	85	83	96	98	98	96	96			
	Step #	1	3	5	7	9	11	13	17	19	21	23	25
Identify Grenades	% GO	57	79	94	64	96	70	72	79	81	62	79	62
	Step #	1	2	3	4	5	6	7	sequence				
Load M16	% GO	100	100	100	100	77	96	92	100				
	Step #	10	11	12	13	14	15	sequence					
Reduce Stoppage M16	% GO	87	98	98	100	92	96	98					
	Step#	18	19	20	21	22		sequence					
Clear M16	% GO	98	75	100	96	98		96					
CLear M203	Step #	2	3	4	5	6							
Grenade Launcher	% GO	100	100	9[illegible]	94	98							
	Step #	8	9	10	11	12							
Load M203	% GO	100	100	100	100	96							
	Step #	14	15	16									
Unload M203	% GO	100	98	98									

Table 24 (continued)

Task													
Disassemble M203	Step #	1	2	3	4	5							
	% GO	28	64	96	96	96							
Assemble M203	Step #	7	8	10									
	% GO	98	98	91									
Function Check M203	Step #	12	13	14	15	19	20	21					
	% GO	96	96	91	79	70	77	34					
Battlesight Zero M16	Step #	1	2	3	4								
	% GO	98	87	98	77								
Prepare Dragon	Step #	1	2	3	4	5	6	7	8	9	10	11	12
	% GO	100	89	100	92	43	94	91	100	100	66	96	72
Stop Bleeding	Step #	2.	3	4	5								
	% GO	64	87	96	85								
Treat for Shock	Step #	7	8	9									
	% GO	92	100	88									
Splint Fracture	Step #	1	2	3	4	5							
	% GO	96	100	74	92	81							
Determine Azimuth	Step #	1	2	3	4	5	6	7					
	% GO	83	79	72	75	70	70	55					
Back Azimuth	Step #	9	10	12	13								
	% GO	64	66	81	79								
Convert Azimuth	Step #	1	2	3	4	6	7	8	9				
	% GO	74	62	58	57	74	66	51	47				

Table 25
% Soldiers "GO" On Each Step of Each Task
Four Month Retention Test
n = 79

Task													
Visual Signals	Step #	1	2	3	4	5	6	7	8	9			
	% GO	68	43	52	48	100	76	85	77	76			
SALUTE	Step #	1	2	3	4	5	6		Sequence		Time		
	% GO	97	96	92	97	96	95		91		99		
Install Radio	Step #	1	2	3	4	5	6	7	8	9	10		
	% GO	100	100	94	99	99	97	97	96	97	96		
Enter Net	Step #	12	13	14	15	16							
	% GO	95	94	91	91	95							
Transmit Message	Type of Steps	Phonetic	Conventional	Procedural									
	% GO	67	68	96									
Vehicle ID: Friend Foe	Step #	1	2	3	4	5	6	7	8	9	10		
	% GO	84	92	92	85	70	89	96	72	96	94		
Vehicle ID: Nomenclature	Step #	11	12	13	14	15							
	% GO	38	57	29	53	32							
Telephone	Step #	1	2	3									
	% GO	100	100	100									
Mount ANPVS-2 on M16A1 Rifle	Step #	1	2	3	4	5	6	7	8	9			
	% GO	99	97	80	63	80	86	82	82	75			
Identify Grenades	Step #	1	3	5	7	9	11	13	17	19	21	23	2
	% GO	58	57	100	58	100	63	68	77	82	54	54	49
Load M16	Step #	1	2	3	4	5	6	7	Sequence				
	% GO	100	99	99	100	86	96	95	99				
Reduce Stoppage M16	Step #	10	11	12	13	14	15	Sequence					
	% GO	87	100	99	97	91	97	100					
Clear M16	Step #	18	19	20	21	22		Sequence					
	% GO	99	100	100	99	100		85					
Clear M203 Grenade Launcher	Step #	2	3	4	5	6							
	% GO	100	100	100	100	100							
Load M203	Step #	8	9	10	11	12							
	% GO	100	100	100	100	100							

Table 25 (continued)

Task													
Unload M203	Step #	14	15	16									
	% GO	100	100	100									
Disassemble M203	Step #	1	2	3	4	5							
	% GO	53	65	95	95	95							
Assemble M203	Step #	7	8	10									
	% GO	100	100	99									
Function Check M203	Step #	12	13	14	15	19	20	21					
	% GO	100	100	89	82	85	81	65					
Battlesight Zero M16	Step #	1	2	3	4								
	% GO	100	76	100	81								
Prepare Dragon	Step #	1	2	3	4	5	6	7	8	9	10	11	12
	% GO	100	65	99	94	44	77	65	92	92	81	82	60
Stop Bleeding	Step #	2	3	4	5								
	% GO	62	94	79	81								
Treat for Shock	Step #	7	8	9									
	% GO	72	99	99									
Splint Fracture	Step #	1	2	3	4	5							
	% GO	95	99	65	82	73							
Determine Azimuth	Step #	1	2	3	4	5	6	7					
	% GO	65	65	65	71	71	71	42					
Back Azimuth	Step #	9	10	12	13								
	% GO	77	72	77	70								
Convert Azimuth	Step #	1	2	3	4	6	7	8	9				
	% GO	54	53	48	46	58	57	49	46				

The following briefly summarizes the most frequent errors on each task.

Load the M16 Rifle: The most common error was that soldiers failed to tap the forward assist; this occurred for both retention tests.

Clear the M16 Rifle: The most common error was that soldiers failed to lock the bolt open. This error did not occur at four months.

Disassemble the M203 Grenade Launcher: Soldiers failed to clear the launcher before starting disassembly, and also failed to remove the quadrant sight. These errors occurred on both tests.

Function-check the M203: Soldiers failed to pull the trigger at the completion of the function check; this error occurred at both tests.

Prepare the Dragon: Soldiers failed to remove the tracker from the carrying bag after the round was prepared, failed to remove the tracker lens cover after the tracker was mounted, and failed to adjust the foot adjust. At the four-month test, soldiers missed these steps and also missed the steps "Lower the bipod until locked in vertical locked position" and "Secure tracker receptacle cover to tracker forward shock absorber."

Splint a Fracture: Soldiers did not position the splints correctly. Typically, they placed the short splint on the outside of the arm, rather than on the inside. This error occurred at both tests.

Stop Bleeding: Soldiers improperly applied the field dressing. Typically, the pad was placed with the wrong side facing the wound. Again, this error occurred during both tests.

Treat for Shock: During the four-month test, soldiers made errors when loosening clothing and equipment.

SALUTE: Soldiers did not report the location; this error did not occur at four months.

Enter the Communication Net: Soldiers failed to ask permission to enter the net. This occurred at two months only.

Visual Signals: Soldiers made errors on most of the signals, with the exception of "Double Time" and "Line Formation," on both tests.

Transmit a Radio Message: Soldiers had problems with the phonetic alphabet during both tests. At four months,

soldiers also failed to perform the "conventional" steps correctly. For example, they did not preface the spelling of a word with the phrase "I spell."

Vehicle Identification: On both tests, soldiers had difficulty recognizing all armored vehicles. The T72 and AM30 were often confused with one another.

Identify Grenades: On both tests, soldiers made errors when selecting a grenade to produce an airburst, to mark the enemy location and produce casualties, and to throw at an enemy advancing up a steep hill.

Battlesight-Zero M16 Rifle: On both tests, soldiers had problems choosing the appropriate number of clicks to move the sights.

Map tasks: On both tests, soldiers had more trouble adding and subtracting than they did following the procedure.

SQT Tasks

During the six-month retention test, we also tested the 123 soldiers on nine SQT tasks not tested previously. The tasks were "Put on M17 Protective Mask," "Replace Filters in M17 Protective Mask," "Install M18A1 Claymore Mine," "Recover M18A1 Claymore Mine," "Install M16A1 Bounding Antipersonnel Mine," "Use Visual Signals" (these consisted of seven signals not previously tested), "Determine Magnetic Azimuth using Compass," "Engage Enemy Target with Hand Grenades," and "Prepare M72A2 LAW for firing." The soldiers had been trained on these tasks in preparation for an SQT that was administered about two months prior to our test. We compared the retention performance scores with the corresponding SQT performance scores for the 104 soldiers for whom we could locate both sets of data.

Table 26 shows these performance measures. The column labeled "Acquisition" refers to their actual SQT scores. After performing each task during the SQT administration, soldiers were given feedback regarding the errors they had made; the soldiers did not repeat the tasks after the feedback was given. Thus, the "Acquisition" scores are not directly comparable to our "First-trial" scores; however, had the tasks been readministered immediately (i.e., parallel to our procedure for the Proficiency group), we could assume that soldiers would have performed all tasks with very few errors.

Most of the soldiers performed all tasks correctly at SQT, and the retention scores for most of the tasks were high. Depending upon our assumptions regarding performance

Table 26
SQT Tasks
Performance on Acquisition and Retention Tests

Task	% Steps "GO"				% Soldiers "GO"		Time on Retention (secs.)	
	Acquisition		Retention					
	Mean	Standard Deviation	Mean	Standard Deviation	Acquisition	Retention	Mean	Standard Deviation
Put on Mask (5 Steps)	97.6	8.2	95.2	14.5	90.5	87.4	14.28	4.92
Change Filter (5 Steps)	97.6	8.8	98.2	7.0	91.3	93.5	425.78	138.97
Install Claymore (14 Steps)	95.9	9.8	98.1	10.7	81.3	92.7*	295.46	76.58
Recover Claymore (6 Steps)	90.3	24.0	99.0	10.5*	82.3	96.9*	205.05	63.03
Install M16 Mine (8 Steps)	99.1	3.6	98.3	9.8	94.5	95.6	138.18	58.73
Visual Signals (7 Steps)	98.7	5.5	93.9	13.9*	92.7	76.0*	Not Timed	
Determine Azimuth with Compass (8 Steps)	99.1	4.1	92.5	14.3*	95.5	71.9*	Not Timed	
Throw Grenade (5 Steps)	98.2	5.7	99.8	2.1*	91.3	98.9*	14.55	8.18
Prepare Law (5 Steps)	100.0	0.0	97.6	7.2*	100.0	88.7*	15.98	4.95

* Difference between mean significant at .05 level.

following SQT feedback, the retention scores can be interpreted as reflecting moderate forgetting on most tasks. The largest drops were for the tasks that we have termed "mental," namely "Visual Signals" and "Determine an Azimuth using a Compass."

The tasks on which the soldiers' performance differed significantly between acquisition and retention (using a correlated-sample t-test and $p < .05$) are starred. Soldiers' performance declined over the two-month period for the tasks "Visual Signals," "Determine Magnetic Azimuth with Compass," and "Prepare the LAW." Soldiers' performance was significantly better during during retention testing than during acquisition for the tasks "Install Claymore," "Recover Claymore," and "Throw Grenade."

We also examined the percentage of soldiers who performed each step of each task correctly on both the SQT and the retention test. Few errors were observed, since most soldiers performed the tasks correctly. The errors that were made were more or less evenly distributed across the steps; no one step was missed more often than any other.

III. YEAR TWO RESEARCH: THE USER'S DECISION AID

The major goal of the Acquisition and Retention project is to produce a convenient, practical method that individual unit commanders and training managers can use when deciding how to allocate training resources. Our assumption is that the core of such a method would consist of a way to estimate or predict a unit's level of proficiency for any given task at any point in time -- that is, an algorithm that generates "pure" task retention functions. With additional information regarding time since last performance and the level of proficiency attained, the user could "locate" the unit on the retention function.

The basis for such an algorithm is the Task Classification System (TCS) described above in the review of Year One research. To summarize briefly, the Year One work on the TCS resulted in the specification of a wide range of task characteristics that relate to task retention. The primary focus of the Year Two effort was to convert the TCS into a usable format.

Based on the literature review, we identified certain task dimensions that were most likely to be related to retention. We then converted these dimensions into rating scales, developed anchor points, and assigned arbitrary weights to each point on the scales. In fact, the weights were determined by an analytic assessment of the relative contributions of the selected dimensions to forgetting, as revealed by the literature. Next, we assessed each scale's reliability and validity by having several judges rate tasks on each scale. We examined both interrater agreement and the correlation between task ratings and actual retention data. These steps were repeated--dimensions were redefined, different weights chosen, new dimensions added--for each of the rating scales of the TCS.

Concurrently, we developed a method for incorporating unit status information. Important predictors of task retention are the time since the last performance and the level of proficiency attained. This information is unique to each unit, and must be supplied by unit personnel.

A final concern was the field implementation of the method -- how should the method be presented to the user, how should judgments be recorded and processed, and how should the resulting predictions and estimates of performance be displayed. We developed two different versions of the method for possible implementation, depending upon potential resources available in the field. The first is a computer program, where users interact directly with the program via a computer keyboard. The second is a paper-and-pencil format, where users record their responses and manually compute task estimates.

The following section presents the current version of what we call the User's Decision Aid (UDA), along with the supporting data on its reliability and validity. The development of the UDA is an ongoing process. We expect that further changes will be made as we apply the instrument to a wider variety of tasks and gain more experience with different types of raters. The data presented here are only the first empirical evidence concerning the reliability, validity, and usefulness of the UDA.

The computerized version of the UDA is an interactive program designed to help unit commanders and training managers apply the findings of this research in their day-to-day training plans. The heart of the UDA is an algorithm that weights and summarizes the relevant characteristics of a task to produce a single task retention "score." This score is used to predict the rate at which the skills or knowledge needed to do a task will be forgotten and the relative level of performance of a unit over time.

The program provides a prediction of the rate of proficiency loss over a 12-month period. The program presents, in tabular form, the predicted percentage of men able to perform the task at one, three, six, nine, and twelve months after last performance (Figure 3). In addition, the program presents the above information in graphic form (Figure 4).

Basically, the user provides information about the tasks by answering a series of questions posed by the computer program. These answers are processed by the program to produce both a retention score and the projected rate of proficiency loss. The program also can be used to incorporate information concerning task performance of the unit. This information can be combined with the task retention information to produce a summary performance prediction for the unit, again in both tabular and graphic forms.

The current version of the UDA is designed to be used on an Apple II+ microcomputer. The program flow and the algorithm are described in more detail below.

The Program

The program contains four main routines:

1. A routine to identify the tasks to be rated
2. A routine to rate individual task characteristics
3. A routine to rate the unit characteristics, and
4. A summary routine which creates a composite task/unit performance prediction.

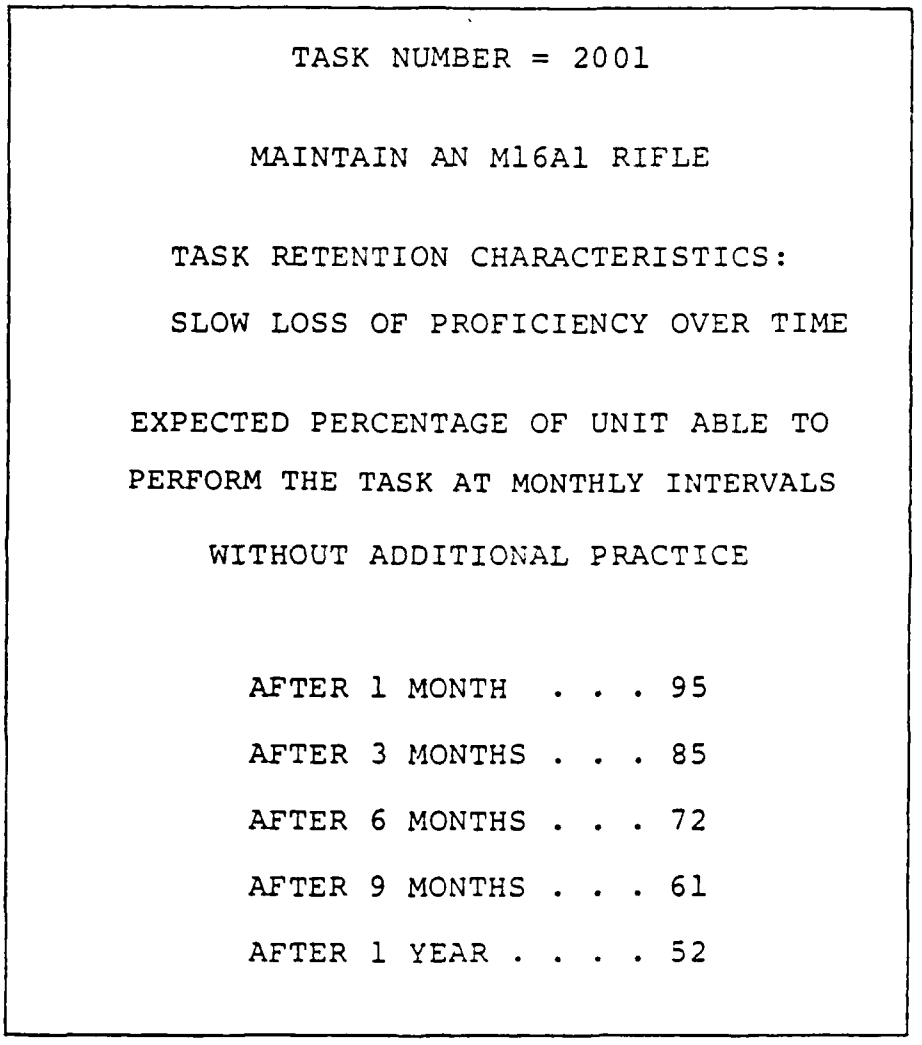


Figure 3. Task rating summary frame (example).

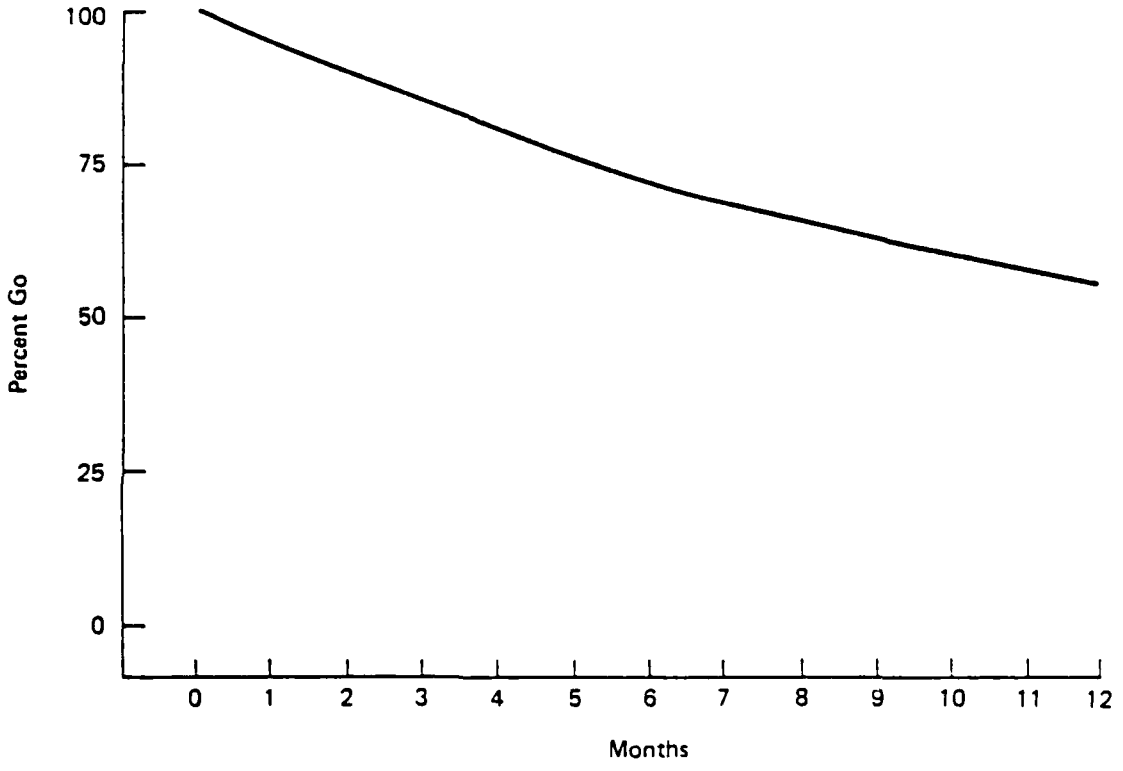


Figure 4. Graphic presentation of the general expected performance over time.

1. Identifying the tasks to be rated. The first part of the program is designed to identify the specific tasks that the user wants to examine. The program anticipates two scenarios; the first is when the user knows beforehand exactly which tasks are of immediate concern to the unit; the second is when the user has only a general notion of unit training needs. In the first instance the user enters the last four digits of the task reference number listed in the Soldier's Manual. Once the user has entered all of the numbers, the program lists out the titles of the tasks to confirm that the numbers were entered correctly, and asks if the user wishes to add or delete tasks from the list.

If the user does not know beforehand which tasks to review, the program aids the selection by presenting a series of branching questions to narrow down the user's choice. For example, within the 11B10 MOS, the user would be asked first to select one of the following broad categories of tasks:

- Basic soldier tasks
- Combat techniques
- Weapons
- Grenades, mines and demolition
- Selected duty positions.

If the user chooses the category "weapons," the program asks for a choice among various weapons as follows:

- M16A1 rifle
- M203 grenade launcher
- LAW
- M60 machinegun.

If the user chooses "M16A1 rifle," each of the specific tasks related to that weapon would be displayed one at a time; the user would indicate whether each should be reviewed. The program then presents the list of tasks selected, and asks if any tasks should be added or deleted.

2. Rating individual task characteristics. After the user has specified the tasks to be rated, the program generates an estimated retention prediction by asking the user to answer a series of questions about each task. The questions follow a sequence based on how the user responds. Each response produces a weighted score and the total of all scores is the final prediction rating. The general flow of the program is shown in Figure 5.

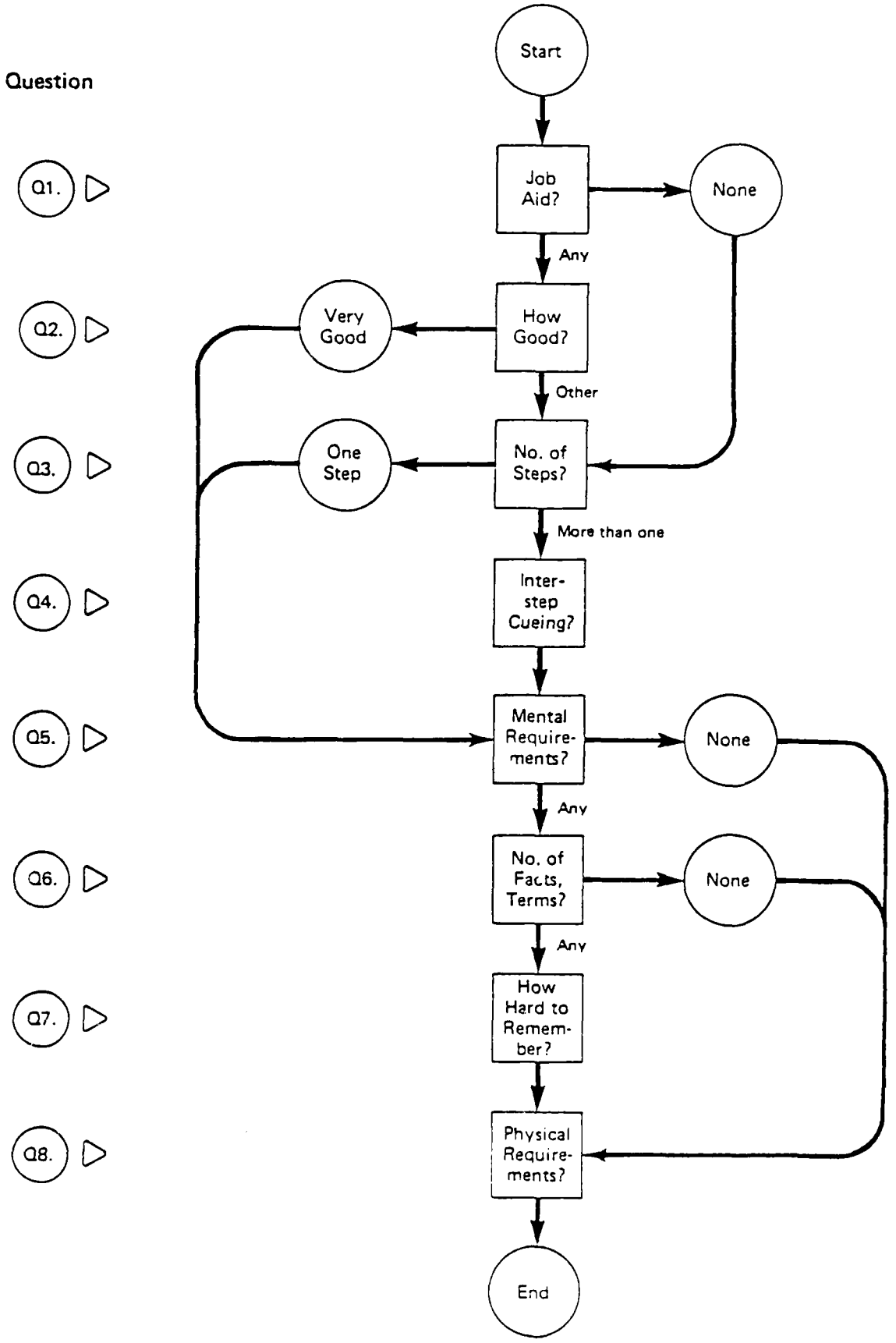


Figure 5. The process flow of the UDA algorithm.

The following section describes each question asked and gives a brief rationale for its inclusion and assigned weight.

Question 1: Are job/memory aids available to the soldier when he performs the tasks?

Answer options are "Yes," No," or "Need more information." If more information is requested, the user is provided with the following:

> Definition: Job/Memory Aids
>
> Job/Memory Aids are devices which help the soldier remember how to do a task or the order in which the steps of the task should be performed.
>
> For example: . . .
>
> - Mnemonics such as S-A-L-U-T-E
> - Labels or printed instructions on a piece of equipment
> - Symbol or color code systems
> - Procedure manuals, but only if they can be used while actually doing the task.

Information at a similar level of detail would be provided on request for each of the questions in the program. The complete set of definitions is presented in Appendix C.

The user's answers are weighted as follows:

- A "yes" is awarded a weight of "1" -- a job/memory aid increases the probability of a soldier remembering how to do a task;
- A "no" is awarded a weight of "4" -- no job/memory aid increases the chance of the soldier making a mistake or not remembering how a step is done.

If the user answers "yes, a job aid is available," the program then asks for an appraisal of the quality of the aid.

Question 2: How would you rate the quality of the job/memory aids?

Answer options are "Very good -- soldier can do the task without any additional instruction"; "Good, but incomplete -- soldier would need some instruction"; "Poor -- the soldier could not do the task without additional instruction.

- A "very good" receives a weight of "1" -- a good aid increases retention
- A "good" receives a weight of "2"
- A "poor" receives a weight of "3" -- a poor aid is weighted the same as having no aid at all.

A good job aid obviates much of the retention problem in a task, even if it has many steps. Thus, questions involving the number of steps are skipped if a "very good" job aid is available. However, if the task has no job/memory aid (Question 1) or the aid is only "good" or "poor" (Question 2) the user is next asked about the number of steps involved in completing the task.

Question 3: How many steps are required to do the task? Answer options are:

- A one-step task receives a weight of "1";
- A task with 2 to 5 steps receives a weight of "2";
- A task with between 6 and 10 steps receives a weight of "3"; and
- A task with more than 10 steps receives a weight of "4."

The rationale is straightforward; a multi-step task is harder to remember than a task with only one or a few steps. The step breakouts (1, 2-5, 6-10, >10) were arrived at through consideration of the literature and the theoretical and empirical limits of short-term memory capacity (i.e., about six "chunks").

The program makes a further distinction with respect to multi-step tasks. If the task involves more than one step the program asks . . .

Question 4: Do the steps tend to follow a natural sequence? The choices are:

- "Most or all steps provide interstep cueing" (which receives a weight of "1")
- "Many of the steps provide interstep cues" (which is weighted "2")
- "Only a few of the steps provide interstep cues" (weighted "4")
- "None of the steps provide any form of cueing -- the steps can be performed in almost any order" (weighted "8").

The assumption of this scale is that even a very complex task is easier to perform if the steps follow a natural or logical sequence. Conversely, the more arbitrary the sequence of steps, or the less "natural" the steps, the more difficult the task is to remember and perform.

Question 5: What are the mental or cognitive requirements of this task?

Mental processing ranges from virtually none when the task involves simple reflexive or repetitive actions (e.g., saluting) to very complex problems involving many variables interacting in a dynamic environment.

This question can be asked in two forms, depending on the answer to the previous questions. If a "very good" job aid is available the above question is amended, "Even with the job aid available, what are . . . etc. . . ." The response choices are:

- "Virtually no mental processes are needed" (weighted "1")
- "Simple mental processes -- memorization of simple stimulus-response sequences" (weighted "4")
- "Complex -- memorization of complex or arbitrary responses" (weighted "6")
- "Very complex" (weighted "8").

Unless the task involves virtually no mental processing the program asks the user to further specify the number of items to be recalled or processed.

Question 6: How many facts, terms, names, rules or ideas must a soldier memorize in order to do this task?

- "None" (weighted "1")
- "A few (1 - 3)" (weighted "2")
- "Some (4 - 8)" (weighted "3")
- "Very many (more than 8)" (weighted "4").

If the task involves the memorization of at least "a few" facts, terms, etc., the program asks about the difficulty a typical soldier would have remembering those items.

Question 7: How hard are the facts, terms, etc., that the soldier must memorize?

- "Not applicable -- the memory aid provides all or most of the needed information" (weighted "1")

- "Not at all hard -- the information is simple and logical or is recalled naturally as the soldier performs the task" (weighted "2")

- "Somewhat hard -- some of the information is complex" (weighted "4")

- "Very hard -- many of the facts, rules, terms, etc. are technical or specific to the task or must be remembered in exact detail" (weighted "8").

Question 8: What are the physical demands of the task?

- "The task makes almost no demands on the performer's ability to control his or her response (e.g., tasks requiring sheer physical strength such as carrying, lifting or pushing) or involving very simple motor actions (e.g., pushing a button)." (weighted "1")

- "The task makes small but noticeable demands on the performer's control over his movements (e.g., driving a small nail, adjusting a carburetor screw, coordinating the movement of two limbs)." (weighted "2")

- "The task requires a fair degree of timing, accuracy and coordination (e.g., driving a manual transmission car, tracking a moving target in a sight)." (weighted "3")

- "The task makes a heavy demand on the performer's physical control (e.g., flying an airplane or helicopter)." (weighted "4").

This question, similar to the previous question concerning the mental requirements of a task, could be asked in the context of a job aid (i.e., "Even with the job aid available, what are the physical demands..." etc.) or no job aid.

3. Rating unit characteristics. The third subroutine is used to rate tasks according to the specific training and performance experience of the user's unit on those tasks. The routine uses this information in two ways:

- The unit information can be used to prioritize tasks for training independent of task characteristics.

- Unit characteristics information can be combined with task characteristics information to produce a unit-specific prediction of future performance.

The user supplies the appropriate information in response to a series of questions. Some of the questions (for example 3, 4, and 5 below) provide multiple categories into which the user must locate the soldiers in his unit.

1. How many troops in the relevant MOS are in the unit?

2. How many of these must be able to perform the task in question?

3. Of these, how many have performed the task in the unit under supervision . . .

   - not at all
   - 1 - 2 times
   - 3 - 5 times
   - 6 or more times?

4. Of those who have performed the task under supervision at least once, how many performed it . . .

   - within the last month
   - between 1 and 2 months ago
   - between 3 and 6 months ago
   - more than 6 months ago?

5. How many were able to perform the task . . .

   - correctly
   - with minor mistakes
   - not at all?

After each task has been described in terms of each of the questions, the program will list out the tasks in order of training priority (highest to lowest) on each of the following criteria:

- Number of men to be trained
- Frequency of previous performance
- Recency of previous performance
- Quality of last performance
- Composite scale -- a combination of all of the above factors.

Task priority is determined by multiplying the number of soldiers in each category by the "weight" assigned to that category. The current weights were arbitrarily assigned. As an example of the computation involved in assessing the, weighted priority value of the quality of task performance, the relevent weights for each category are:

- Number performing task correctly = N x "0"
- Number making minor mistakes = N x "1"

- Number unable to do task = N x "2".

The total task score on this scale would be the sum of the three category scores. The "composite" score is the sum on all of the criterion factors.

4. Summary. The final routine combines the task rating and the unit characteristics information to produce a unique, unit-specific prediction of performance. These predictions are presented for each task in the form of the expected percentage of soldiers able to perform the task at 1, 3, 6, 9 and 12 months since the last performance. The program also estimates the average time since the last performance of the task in the unit and then computes the current location of the unit on the retention curve. The graphic presentation of these estimates is shown in Figure 6.

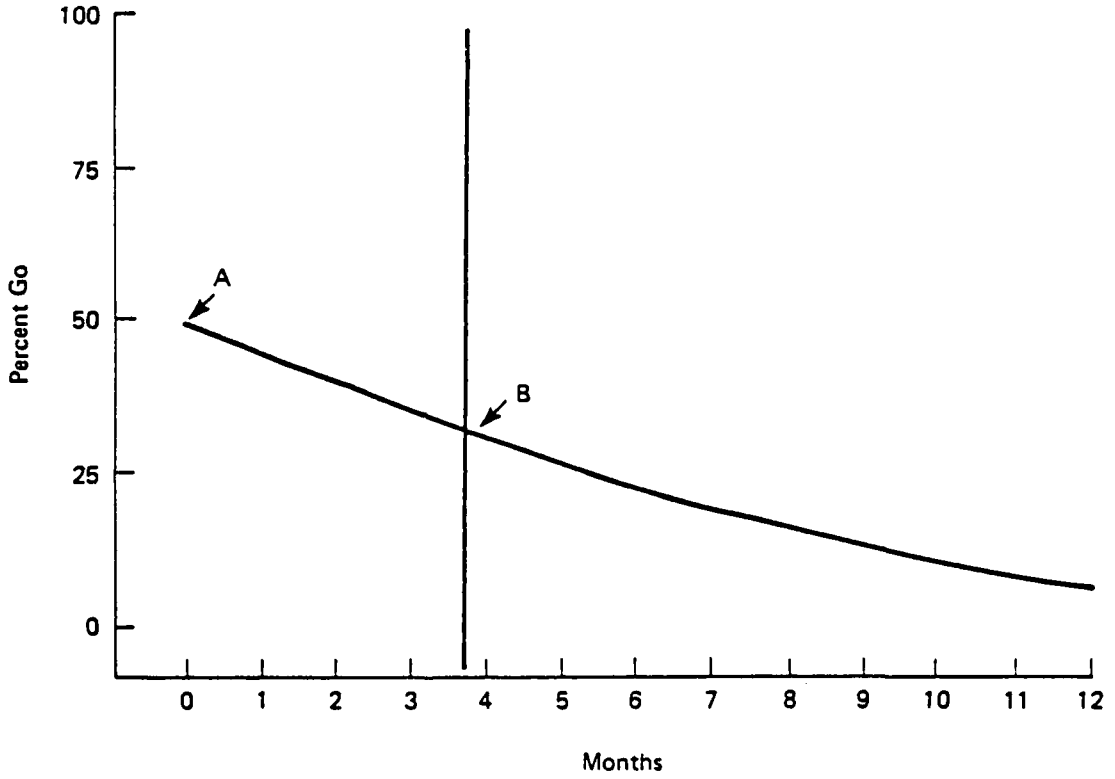
Estimating Performance Based on Retention Scale Scores

The UDA is designed as a prototype to demonstrate how the knowledge gained in the project could be used by operational units. The actual calculations, weights and equations used to predict performance are based on assumptions about the relationship between the retention scale score and actual loss of proficiency over time. Two assumptions are made: that the correlation between the scale score and the rate of proficiency loss is positive, and that the relationship is non-linear. Thus, the greatest loss of proficiency is expected to occur immediately after initial learning with successively smaller losses occurring with each subsequent period without additional practice.

The correlational assumption is based on the belief that the scale measures important components of the retention/acquisition characteristics of a task; the more important these components are, the more likely the soldier is to retain or forget the skills or knowledge needed to do the task.

In the present computerized version of the UDA the prediction is expressed as the percentage of soldiers in a unit who are able to perform a task. The prediction is presented in two forms: a general prediction based only on the characteristics of the task (i.e., when unit characteristics are not known) and a unique prediction which combines the task and unit characteristics. The general prediction assumes that 100% of the soldiers could perform the task at their last performance. No assumption is made about their level of mastery or amount of overtraining.

We have also developed a paper-and-pencil version of the UDA. This version, presented in Appendix C, can be used by unit training managers and field personnel to generate



Expected percentage of unit able to . . .
maintain an M16A1 rifle without additional practice

"A" is the percentage of the unit able to perform the task at the last performance.
"B" is the current predicted percentage of the unit able to perform the task.

Figure 6. Graphic presentation of the unit's expected performance at last performance, currently and over time.

predicted levels of performance for any time interval. This paper-and-pencil version includes instructions to the user regarding how to weight each answer, how to combine ratings, and how to use the scores to generate a prediction. We re-emphasize that the UDA is still undergoing development and refinement; however, given its success in predicting retention performance (to be described in later sections of this report), we are confident that its use can be beneficial.

The rate of proficiency loss -- the proportional decrease in the percentage of soldiers able to do a task -- was initially set at one percent per month per scale score point. However, analysis of the two-month retention data led us to revise the rate to 2.5 percent per month for all scale score points over 12. We found that tasks with scores of 12 or less were retained by virtually all soldiers. Thus a task rated with a score of 18 would be adjusted by subtracting 12 in order to compute the actual prediction.

The general form of the equation used to convert a task rating to an estimated proficiency score is:

Estimated proficiency = A - (A (rating-12) x .025))

Where A = the percentage of soldiers who could perform the task correctly at last performance.

For example, for a group of soldiers, all of whom were able to perform a task with a scale score of "22," the expected percentage able to perform the task one month later would be 100% - 100% x (10 x .025) = 75%. Note that the formula predicts a proportional decrease over time, not an absolute decrease. Thus, for the same group one month later the expected percentage able to perform the task would be 75% -75% x (10 x .025) = 56%.

The range of predictions produced by this formula is shown below for three hypothetical tasks at 0, 1, 3, 6, 9 and 12 months since last practice.

	Scale Score		
	1-12	13	40
0 months	100%	100%	100%
1 month	100%	98%	30%
3 months	100%	93%	3%
6 months	100%	86%	0%
9 months	100%	80%	0%
12 months	100%	74%	0%

The unique or unit-specific prediction combines the general prediction task scale score formula with two additional pieces of information concerning the soldiers performing the task:

- The percentage of the soldiers who were able to perform the task at the last performance, and
- The elapsed time since these soldiers last performed the task.

The first set of data is used to set the starting point on the retention curve. That is, while in the computation of the general prediction it was assumed that 100 percent of the soldiers were able to do the task, in the unique prediction formula the user can specify or estimate the actual number. The computation of the predicted performance curve is the same as in the general prediction. Thus, for a unit in which only 50 percent of the soldiers could last perform a task with a scale score of "25," the expected percentage able to perform the task after one month would be 50% - 50% x (13 x .025) = 34%.

The other item of information utilized in the unique prediction is the elapsed time since the soldiers in the unit last performed the task. This information is used to determine the unit's current location on the unique retention curve. If the soldiers in the unit all performed the task at the same time the program merely notes that point on the curve. However, if some soldiers performed the task at different times in the past, an average time since last performance is computed, as the unit's current position on the retention curve.

The Reliability and Validity of the UDA Algorithm

The value of the UDA depends upon its ability to produce consistently accurate estimates of performance for a wide variety of tasks when used by field personnel. In order to determine the reliability and validity of the UDA, we collected four sets of ratings for each of the 27 tasks being examined in Year Two. The individual raters' responses were compared in order to estimate the UDA reliability in producing consistent results. The collective ratings were then compared with actual retention performance of soldiers on the tasks. In this section we summarize the results of these analyses.

Interrater reliability. Four sets of ratings were collected for each of the 27 tasks. Three of the rating sets were provided by individual raters. The fourth set was the consensus rating of two raters who worked together in completing the exercise. All of the raters were civilian members of the project staff. None could be considered an "expert" on any of the tasks being rated -- in the strict sense of that term. All but one of the raters were familiar with the tasks, having either observed the task being performed or, in one instance having actually performed the task under training or testing conditions. All of the raters were

familiar with the application of psychometric scales, had designed or applied such scales in the past and were conversant with the techniques of job and task analysis.

An additional factor to be noted is that the three individual raters each participated in the development of the earlier version of the UDA (the TCS) to the extent that they had applied the earlier scale to similar tasks, or were involved in subsequent discussions which led to the current version of the algorithm. One of the raters was the author of the UDA. Thus, the raters were generally conversant with the approach being used, and in three cases were also familiar with the intent and theoretical background behind the scales. In other words, the raters were probably more familiar with the rating scale but slightly less familiar with the tasks than the typical potential user might be.

Table 27 presents the distribution of the mean scale scores for each of the 27 tasks. The tasks are listed in order from most to least difficult. The range of possible scores on the rating scale is from 5 to 40. The individual rater's scores ranged from 7 to 33 and the mean scores ranged from 11.75 to 31. Loading and unloading the M203 grenade launcher were the easiest tasks, each with a mean rating of 11.75. Identifying vehicles by name and whether friend or foe were the most difficult tasks with mean scores of 31 and 27.75 respectively.

Interrater Correlations. Table 28 shows the pairwise correlations between total rating scores of the four raters on 27 tasks. All correlations reached a level of statistical significance and ranged from $r=.64$ to $r=.89$, indicating that for this set of raters the reliability of the instrument was high.

Table 29 shows the degree of agreement among raters by item on the algorithm. The table illustrate that several questions elicited highly variable responses, specifically, the presence of interstep cues and the number of facts requiring memorization to complete the task. On three questions there was moderate agreement: the number of steps in a task, the level of difficulty of the memorized facts and the physical demands of the task. Relatively high agreement was found on the questions relating to the presence or absence of a job aid and the overall mental requirements of the task. The overall level of agreement across all seven questions was 64.2 percent.

Tasks that were rated most uniformly by the raters include:

- Convert Azimuth - 86.6%

Table 27
Mean Scale Scores by Task

Task	Mean Scale Score
Identify Vehicle Nomenclature	31.00
Identify Vehicle: Friend/Foe	27.75
Determine Azimuth	25.00
Identify Hand Grenades	24.25
Convert Azimuth	23.30*
Visual Signals	22.50
Back Azimuth	21.75
Radio Transmit	21.30*
Mount AN/PVS-2	20.30*
SALUTE	19.75
Install Radio	19.50
Stop Bleeding	19.50
Operate Radio	19.00*
Prepare Dragon	18.50
Apply Splint	18.50
Function Check M203	16.50
Treat Shock	16.25
Clear M16A1	16.00
Reduce Stoppage M16A1	15.75
Battlesight/Zero M16A1	15.75
Load M16A1	15.25
Disassemble M203	15.25
Clear M203	14.75
Install Telephone	14.00
Assemble M203	13.25
Load M203	11.75
Unload M203	11.75

* Average scale score is based on 3 rather than 4 raters on each instance 1 rater was excluded because of incomplete answers.

Table 28

Interrater Correlations on Total Scale Score

	RATER			
RATER:	1	2	3	4
1	-	.66 a	.81 b	.83 c
2	-	-	.89 a	.64 d
3	-	-	-	.81 c
4	-	-	-	-

a = based on ratings on 24 task scores
b = based on ratings on 27 task scores
c = based on ratings on 26 task scores
d = based on ratings on 23 task scores

Table 29

Level of Rater Agreement on Individual Question:
Percent of Raters Response Agreement

Question**	Percent Agreement*
Presence/absence of job aid	88.9%
Quality of job aid	not rated
Number of steps to do task	66.7%
Presence of intersteps cueing	36.3%
Overall mental requirements	72.4%
Number of facts to be memorized	42.9%
Level of difficulty to memorize facts	60.3%
Cverall physical requirements	68.6%

*Percent of pairwise matches of responses among all raters answering the question. This is a conservative test of rater agreement in that raters had to agree exactly in their responses. Thus, systematic differences among raters (i.e. a tendency to rate high or low) exaggerates the level of disagreement.

- Back Azimuth - 85.7%
- Vehicle Identification: Nomenclature - 85.7%
- Vehicle Identification: Friend-Foe - 78.6%.

Tasks about which the raters tended to disagree included:

- Install Telephone - 48.4%
- Clear M203 - 48.5%
- Install Radio - 48.6%
- Identify Grenades - 50.0%.

The four tasks with the highest level of interrater agreement were also among those rated most "difficult" by the raters overall. However, the four tasks with the lowest agreement rating consist of tasks with very low, moderate and high difficulty ratings.

The distribution of rater scores on the 27 tasks is relatively broad on most of the scales. However, the distribution with respect to the presence or absence of a job aid was heavily skewed in the direction of no aid present. Similarly, the tasks were all rated low on the scale relating to physical requirements.

Interquestion correlations. In order to insure that we were not merely asking the same questions in a variety of forms, we computed the correlations between the responses to the questions. We found a high level of intercorrelation among those questions relating to the mental/cognitive load imposed by the tasks. Significant positive correlations were found among the responses with respect to the presence of inter-step cues in the task, the overall mental requirements, the number of facts, terms, etc. to be memorized, and the difficulty of the to-be remembered facts, terms, etc.

A negative correlation existed between the overall physical requirements of a task and the mental requirements and the memory demands of the task. An intuitive interpretation of these results would be that mental requirements and physical requirements vary inversely in importance among tasks. However, since there was so little variance in the ratings of physical demands for this set of tasks (i.e., almost all raters rated almost all tasks as having little or no physical demand), it is likely that the result is an anomaly.

In summary, it appears that three distinct aspects of tasks are measured by the UDA. These are:

- mental/cognitive demands of the task - involving the complexity of the mental processes required, interstep cues, number of facts requiring memorization, and ease of the material to be memorized

- aids to task completion - availability of and the quality of job aids; and

- length of the task - the number of steps involved in completing the task.

A fourth aspect of the tasks, physical demands, also emerged from the analysis. However, the tasks rated in this study did not vary sufficiently on this dimension to give the scale an adequate test.

Summary

The analysis of the reliability of the UDA provides mixed results. On the one hand, the overall consistency of responses among the raters was high, suggesting that the questions probe comprehensible aspects of the tasks. However, the questions relating to the presence of interstep cues, and the number of facts to be memorized appear, in particular, to require additional clarification in order to reduce inconsistent ratings.

Examining the tasks themselves, we found that they varied widely on most of the questions. This demonstrates that the UDA is potentially sensitive to differences in a large variety of tasks. However, the questions pertaining to job aids and the overall physical demand of tasks were found to produce a skewed distribution; relatively few tasks had job aids or presented a significant physical challenge to the soldier.

Finally, by examining the relationships among the task characteristics we found that one dimension appears to predominate: the mental/cognitive demands of the task.

Relationship Between Observed Performance Scores and Ratings

Correlations were computed between the average scale score of the four raters and the performance measures collected at the two-month retention testing. The performance variables were the percentage of steps completed within each task, the percentage of soldiers completing the task, and the mean time to complete (selected tasks). No significant correlations were obtained for the mean-time-to-complete measure.

The correlations between consensus task scale scores and two criterion variables, percentage of steps completed by soldiers trained to mastery or proficiency, and percentage of soldiers trained to mastery or proficiency performing the task correctly, are shown below:

	r=
Percentage of soldiers completing the task	
Proficiency group.	-.71
Mastery group.	-.73
Percentage of steps completed within the task	
Proficiency group.	-.95
Mastery group.	-.80

Correlations were also computed between answers to the seven questions underlying the algorithm and the performance measures. The four mental/cognitive items all correlate at a statistically significant level with the percentage of steps completed and percentage of soldiers performing the task correctly. The questions regarding availability and quality of job aids, physical demands, and number of steps in the task correlated significantly, but at a lesser statistical level, with particular criterion variables.

Discussion and Recommendations

This preliminary examination of the UDA algorithm revealed several important findings. First, the interrater reliability is relatively high. Second, the algorithm appears to tap characteristics of tasks that are relevant to the training of military personnel. The scores and the individual questions on the algorithm correlate significantly with a variety of performance measures being gathered to examine retention. These facts suggest that further development of the instrument is appropriate.

This analysis has also highlighted the directions that such development should take. The algorithm needs further testing and refinement in four areas. First, terms now used on the algorithm require more complete, unambiguous definitions. Second, the instrument should be tested with a greater number of tasks that have more diverse characteristics. The tasks for which the algorithm remains essentially untested are those with job aids and those that make significant physical demands on the performer. (The Year 1 data, for which all tasks were job-aided, likewise showed little or no variance on this dimension; hence, these data could not serve as a test of it. Rather, they indicated that the dimension itself was important to consider.) A sample of tasks with one or both of these characteristics should be included in subsequent investigations. Third, the number and variety of raters using the algorithm need to be increased. An important next step should be to have potential "users", including subject matter experts, rate the new tasks. The number of raters who are not as familiar with the tasks could also be expanded and comparisons made between the two groups. Finally, the algorithm should be examined in relation to retention over longer periods of time, i.e., four months and six months.

IV. PREDICTING PERFORMANCE

Regression Analyses

An important practical question for this project is whether acquisition and retention performance can be predicted from other information. We employed two types of regression analyses to predict performance: the first type of regression analysis used individual difference variables to predict soldiers' performance separately for each task. The second analysis used task difference and group difference variables to predict overall task performance: that is, differences among the entire set of tasks.

Acquisition. In the first set of regression analyses, we wanted to see whether measures of individual ability and frequency and recency of performing a task would predict first-trial Acquisition performance. As was discussed previously, the pattern of relationships between ASVAB scores and performance was unsystematic. Thus, we decided to use AFQT and the ASVAB Combat Area composite scores as predictors in the individual difference regression analyses. We chose AFQT because it is used by the Army to derive a Mental Category score; we chose the ASVAB Combat Area composite score because 11B soldiers are selected into their MOS on the basis of this measure.

We performed a regression analysis to predict individual soldier's performance for each performance measure of each task. We found that the set of predictors described above did not account for more than 16% of the variance in any performance measure for any task. The only tasks where the multiple correlations were significantly different from zero for any measure were "Load M16 Rifle," "Identify Grenades," "Disassemble M203," "Battlesight Zero M16 Rifle," "Prepare Dragon," "Treat for Shock," "Back Azimuth," and "Convert Azimuth." In each case, between 10% and 16% of the variance in performance was accounted for.

This might be a case where using COHORT companies may not have been advantageous. Their similarity of experience may have reduced the variance of these individual measures and hence the potential impact on performance. Another possible explanation for this finding is that we did not measure another critical variable -- namely, level of initial learning.

The second type of regression analysis was performed to determine whether task difference variables and group difference variables could predict overall first-trial Acquisition performance. The variables used to predict

performance accuracy were the task rating derived from the UDA (as discussed in Chapter III), the percentage of soldiers who reported that they had performed the task in the last six months, and the percentage of soldiers who reported that they had performed the task during the previous month.

Prior to the conduct of this analysis, we decided that the basic UDA rating might be insensitive to differences in task duration, and thus would be inappropriate as a predictor of time measures. Thus, when predicting the mean time required to perform a task, we transformed the UDA rating by multiplying it by the standard time required for SQT. We called this variable the "UDA time rating".

Three regression equations that included the predictor variables described above were employed. The criterion variables used in the equations were the percentage of soldiers who were "GO" on each task, the mean percentage of steps correct on each task, and the mean time on each task.

A matrix displaying the zero-order correlations between the predictor and criterion variables used in the group regression analyses is shown in Table 30. The variables measuring accuracy of performance ("Percentage of soldiers GO" and "Mean percentage of steps GO"), had high positive correlations with each other, and high negative correlations with the UDA rating and the UDA time rating. (Recall that higher UDA ratings are hypothetically associated with poorer performance.) "Mean time" had a high negative correlation with "Percentage of soldiers GO" and a high positive correlation with the UDA time rating. Estimates of the group's recency and frequency of performing the tasks did not correlate very highly with the other predictors or the criterion variables. Although some of the correlations between recency or frequency and the criterion variables were significantly different from zero, none accounted for more than 22% of the variance in any of the criterion measures.

The squared multiple correlations for the regression of the task predictors on the group performance measures are shown in Table 31. The multiple correlations of the predictors with "Percentage of soldiers GO" and "Mean percentage of steps GO" (both estimating accuracy of performance) were both significantly different from zero, while the multiple correlation of the predictors with "Mean time" was not significantly different from zero.

Thus, for first-trial Acquisition scores, these series of analyses suggest that although soldiers' individual differences do not seem to predict their performance on a <u>given</u> task, information about group and task characteristics can be used to predict <u>group</u> performance on a <u>set</u> of tasks. A later section will discuss these regression analyses in more detail.

Table 30
Intercorrelations of Predictors and Criteria Group and Task Variables Acquisition Test

	UDA Rating	UDA Time Rating	% Soldiers Who Reported Having Done Task	% Soldiers Who Reported Doing task in Previous Month	Mean % Steps "GO"	% Soldiers "GO"	Mean Time
UDA Rating	1	.77**	−.08	−.37	−.71*	−.83*	.37
UDA Time Rating		1	−.34	−.28	−.83**	−.75**	.60**
% Soldiers Who Reported Having done Task			1	.47*	.40*	.21	−.08
% Soldiers Who Reported Doing Task in Prev. Month				1	.40*	.40*	−.22
Mean % Steps "GO"					1	.84*	−.36
% Soldiers "GO"						1	−.59**
Mean Time							1

* $p < .05$, based on $n = 27$
** $p < .05$, based on $n = 20$

Table 31
Squared Multiple Correlations Between Group/Task Variables and Group Performance Measures Acquisition Test

Group Performance Measure	R^2
% Soldiers "GO"	.71*
Mean % Steps "GO"	.62*
Mean Time	.33

* $p < .05$

Two-month retention. We performed multiple regression analyses similar to those used to analyze the Acquisition data to see if individual difference variables or group and task variables could predict two-month retention performance. The first type of regression analysis included the same predictor variables we used for Acquisition: AFQT, the Combat Area composite score from the ASVAB, and the Frequency score, which indicated whether or not the soldier had performed the task since the Acquisition test. We used each soldier's performance score on the first trial of Acquisition and the training condition to which each soldier was assigned (Mastery or Proficiency) as additional predictors. Again, we conducted a separate multiple regression analysis for each performance measure on each task. It was necessary to perform separate regressions for each task since all soldiers were in the Mastery condition for some tasks and in the Proficiency condition for other tasks. Also, soldiers' frequency scores differed across tasks; they performed some tasks while not performing others following the Acquisition test.

For most tasks, our regression equations accounted for a higher proportion of the variance in two-month retention performance than they could account for when predicting Acquisition performance. Prediction of performance for the mental tasks was fairly good. We found significant multiple correlations between the set of predictor variables and at least one of the dependent measures for the following tasks: "SALUTE," "Splint Fracture," "Enter the Net," "ID Vehicles: Friend-Foe," and "Determine Azimuth." Multiple correlations were marginally significant for the tasks "Visual Signals," "ID Vehicles: Nomenclature," and "Back Azimuth."

Our individual difference variables did not predict performance very well on the physical tasks. However, most of the soldiers performed many of the physical tasks (e.g., installing the radio and telephone, and tasks dealing with the M16A1 rifle or the M203 grenade launcher) correctly on the two-month retention test, so there was little variability in the performance measure to be predicted.

A second type of regression analysis was performed to predict overall two-month retention performance from knowledge of the tasks, knowledge of the recency and frequency of task performance by the group, and by knowledge of how well the group performed the set of tasks during Acquisition. For this analysis, the predictor variables were the UDA rating for each task, the percentage of soldiers who said they had performed the task at least once since the Acquisition test, the percentage of soldiers who reported that the last time they had performed the task was during the month prior to testing, and the average first-trial performance on each task during Acquisition.

Table 32 shows the zero-order correlations between the predictor and criterion variables used in this analysis. The Acquisition performance measures used as predictors were fairly highly correlated with the corresponding criterion two-month retention performance measures. The UDA ratings were fairly highly correlated with both the Acquisition performance measures used as predictors and the two-month retention performance measures. The predictor variables representing the frequency and recency of soldiers' performing the tasks were significantly correlated with each other, however, they were not significantly correlated with any of the other predictors or criteria.

The squared multiple correlations between the set of predictors and the average two-month performance measures are shown in Table 33. Again these regression equations accounted for a higher proportion of the variance in group performance than we could account for when predicting individual performance. Compared to the results of the analyses of the Acquisition data, the only large change in predictability of performance is for the time measure. For the Acquisition test, the multiple correlation between the predictors and time was not significantly different from zero, while the multiple correlation between the set of predictors and performance time in the two-month retention test was almost equal to 1.0. This drastic increase in predictability occurred because we included mean time on the first trial of Acquisition as a predictor in the regression equation. While for the accuracy performance measures, the UDA rating is as good a predictor of two-month retention performance as is knowledge of group performance during Acquisition, the same is not true for the time measure. For the prediction of mean time, the UDA rating does not predict group performance nearly as well as knowledge of mean time to perform the task on Acquisition. A later section will discuss these analyses in more detail.

Four-month retention. Again, we performed regression analyses to determine whether four-month retention performance could be predicted by individual difference variables and by group and task variables. We performed two types of regression analyses. The first type of regression predicted individual performance from knowledge of individual difference variables and knowledge of previous performance measures. The second type of analysis predicted group performance from knowledge of the task characteristics, knowledge of the group's recency and frequency of performance of each task, and knowledge of the group's average performance on previous tests.

We computed squared multiple correlations between the individual difference predictors and the individual four-month retention performance measures. Prediction of the four-month performance measures was, for the most part, not

Table 32
Intercorrelations of Predictors and Criteria Group and Task Variables 2 Month Retention Test

	UDA Rating	UDA Time Rating	% Soldiers Reported Having Done Task	% Soldiers Reported Doing Task in Previous Month	Mean % Steps "GO" (1st Trial Acquisition)	% Soldiers "GO" (1st Trial Acquisition)	Mean Time (1st Trial Acquisition)	Mean # Steps "GO" (2 Month Retention)	% Soldiers "GO" (2 Month Retention)	Mean Time (2 Month Retention)	Trials to First Criterion (Acquisition)
UDA Rating	1	.77**	.24	.20	−.71*	−.83*	.37	−.81*	−.73*	.36	.80*
UDA Time Rating		1	.12	.18	−.83**	−.75**	.56**	−.62**	−.31	.62**	.73**
% Soldiers Reported Having done Task			1	.45*	.01	−.08	−.002	−.02	.15	−.02	.10
% Soldiers Reported Doing Task in Previous Month				1	−.05	.07	−.44	−.26	−.04	−.39	−.09
Mean % Steps "GO" (1st Trial Acquisition)					1	.84*	−.36	.76*	.61*	−.39	−.82*
% Soldiers "GO" (1st Trial Acquisition)						1	−.59**	.67*	.69*	−.52**	−.89*
Mean Time (1st Trial Acquisition)							1	.04	−.06	.94**	.60**
Mean # Steps "GO" (2 Month Retention)								1	.78*	−.06	−.73*
% Soldiers "GO" (2 Month Retention)									1	−.07	−.73*
Mean Time (2 Month Retention)										1	.53**
Trials to First Criterion (Acquisition)											1

* $p < .05$, based on $n = 27$
** $p < .05$, based on $n = 20$

Table 33
Squared Multiple Correlations Between Group/Task Variables and Group Performance Measures 2 Month Retention Test

Group Performance Measure	R^2
% Soldiers "GO"	.70*
Mean % Steps "GO"	.79*
Mean Time	.92**

* $p < .05$, based on $n = 27$

** $p < .05$, based on $n = 20$

quite as good as prediction of the two-month retention performance measures. No more than about 25% of the variance of any performance measure was accounted for by the set of predictors.

The second regression analysis was performed to predict group performance from knowledge of the group's past performance and knowledge of the tasks. Table 34 shows the correlations between all predictor and criterion variables used in this analysis. The Acquisition performance measures used as predictors in the regression analysis were fairly highly correlated with the criterion four-month performance measures. The UDA rating and UDA time rating were also highly correlated with the four-month retention performance measures. However, the estimates of the group's recency and frequency of performing the tasks did not have high correlations with any of the criterion performance measures.

The squared multiple correlations between the set of predictors of group performance and each performance measure for the four-month retention test are shown in Table 35. All the multiple correlations between the predictors and the four-month retention performance measures were significantly greater than zero. Comparing these results with those from the individual regression analyses suggests that group performance is easier to predict from knowledge of the group and the tasks, than is individual performance from knowledge of the individual differences in experience and performance.

Model Comparisons

We performed a series of model comparisons to assess the value of using different sets of variables to predict group performance on the experimental tasks on the first trial of Acquisition, at two months, and at four months. We performed different regression analyses for each of the following dependent variables: Percentage of soldiers "GO" on the tasks, mean percentage of steps "GO" on the tasks, and mean time for each timed task. The regression models contained variables that described the group's previous experience with performing each task and a variable derived from the UDA task ratings (as discussed in Chapter III above). When predicting performance on the Retention tests, we also included as predictors the corresponding mean first-trial Acquisition performance measure for the group. This section will discuss the models used to predict group performance at each testing session.

This set of model comparisons addresses several questions. First, we wanted to know what kinds of variables predicted performance well. We also wanted to determine the most "cost-effective" set of predictors. Given the variables that represent UDA ratings, soldiers' experience with a task,

Table 34
Intercorrelations of Predictors and Criteria Group and Task Variables 4 Month Retention Test

	UDA Rating	UDA Time Rating	% Soldiers Reported Having Done Task	% Soldiers Reported Doing Task in Previous Month	Mean % Steps "GO" (1st Trial Acquisition)	% Soldiers "GO" (1st Trial Acquisition)	Mean Time (1st Trial Acquisition)	Trials to Criterion (Acquisition)	Mean % Steps "GO" (4 Month Retention)	% Soldiers "GO" (4 Month Retention)	Mean Time (4 Month Retention)
UDA Rating	1	.77**	.39*	−.15	−.69*	−.83*	.34	.77*	−.81*	−.76*	.37
UDA Time Rating		1	−.06	−.02	−.83**	−.77**	.55**	−.56**	−.79**	−.62**	.55**
% Soldiers Reported Having done Task			1	.14	.01	−.08	−.27	.19	−.23	−.14	−.43
% Soldiers Reported Doing Task in Previous Month				1	−.07	.13	−.24	−.21	−.06	−.14	−.36
Mean % Steps "GO" (1st Trial Acquisition)					1	.85*	.35	−.76*	.76*	.60*	−.44**
% Soldiers "GO" (1st Trial Acquisition)						1	−.57**	.81*	.70*	.72*	−.61**
Mean Time (1st Trial Acquisition)							1	.41	−.22	−.41	.94**
Trials to Criterion (Acquisition)								1	−.61*	−.61*	.44
Mean % Steps "GO" (4 Month Retention)									1	.85*	−.22
% Soldiers "GO" (4 Month Retention)										1	−.40
Mean Time (4 Month Retention)											1

* $p < .05$, based on $n = 27$
** $p < .05$, based on $n = 20$

Table 35
Squared Multiple Correlations Between Group/Task Variables and Group Performance Measures 4 Month Retention Test

Group Performance Measure	R^2
% of Soldiers "GO"	.62*
Mean % of Steps "GO"	.76*
Mean Time	.93**

* $p < .05$, based on $n = 27$

** $p < .05$, based on $n = 20$

and variables describing soldiers' previous performance, we can roughly order these by the difficulty and expense necessary to obtain each. Determining a UDA rating is obviously the least expensive, since it is entirely analytic and does not require any data collection. Obtaining data on soldiers' task experience would require (minimally) access to their individual Job Books or individual soldier interviews. Assuming the it is not routinely done, collecting task performance data would obviously be the most costly.

Thus, a UDA rating would be our best choice for a predictor because it costs least to obtain. If the UDA rating alone doesn't predict performance as well as the full model, we would next want to include information about the group's experience at performing the task in a reduced model, because it would not cost as much to obtain this information as it would to actually test the soldiers.

Acquisition. For the Acquisition test, the full predictive model for each dependent variable contained as predictors, the percentage of soldiers who reported they had performed each task at least once during the last six months, the percentage of soldiers who reported that the last time they performed the task was less than a month prior to testing, and the task UDA rating. The squared multiple correlation for the models were significantly greater than zero for the dependent variables "Percentage of steps GO," and "Percentage of soldiers GO."

Given that the full model for these two dependent variables predicted first-trial Acquisition performance significantly better than chance, we wanted to know whether a model containing only the UDA rating might predict performance as well as the full model containing all the predictors. In three separate analyses, we computed the squared multiple correlations between the UDA rating and each dependent variable, then compared the squared multiple correlation for each reduced model with the squared multiple correlation for the corresponding full model. We then performed a test to determine whether, for each dependent variable, the full model predicted significantly better than the reduced model.

For the dependent variable "Percentage of soldiers GO," the full model containing all the predictors predicted no better than the reduced model containing only the UDA rating as a predictor. This result suggests that the UDA rating predicted the percentage of soldiers passing a task as well as a regression model containing the UDA rating and information about the group's recency and frequency of performing the tasks.

However, for the dependent variable "Percentage of steps GO," the full model containing all the predictor variables predicted performance significantly better than the reduced

model containing only the UDA rating, $F(2,23) = 3.42$, $p < .05$. Although the UDA rating predicted the percentage of steps "GO" better than chance, it did not predict as well as a model containing information about the recency and frequency of performance and the UDA rating.

Although the multiple correlation between the three predictors and the mean time to perform the task was not significantly different from zero, the zero-order correlation between the "UDA time rating" (the UDA rating multiplied by the time allowed to perform the task during SQT) and the time to perform the task on the first trial of Acquisiton was significantly greater than zero, $p < .01$.

Two-month retention. For the two-month retention test, the full model used to predict each performance measure contained as predictors, the percentage of soldiers who reported they had performed each task since Acquisition, the percentage of soldiers who reported that they had performed the task during the last month, the UDA rating, and the group's performance obtained on the first trial of Acquisition. For example, when predicting the percentage of soldiers "GO" after two months, we included as predictors the percentage of soldiers who were "GO" on the first trial of Acquisition and the mean number of trials it took to perform the task correctly one time.

The multiple correlations for each full regression model were significantly different from zero, as shown in Table 33. We will discuss the model comparisons for each dependent variable separately.

We first looked at the dependent variable "Percentage of soldiers GO." We compared the full model containing all predictors with a reduced model containing only the UDA rating. We found that the full model predicted no better than the UDA rating alone, $F(4,21) = 2.8$, $p > .05$. Thus, for this set of data, we need no more information than the UDA rating to predict the percentage of soldiers passing the tasks.

The next model comparison used as a dependent variable "Mean percentage of steps GO." We first compared the full model with the reduced model containing only the UDA rating, and found that the reduced model did not predict performance as well as the full model. We then compared another reduced model containing only variables that are easy to obtain (UDA rating, percentage of soldiers performing the task since Acquisition, percentage of soldiers performing the task in the last month). This time we found that the reduced model predicted the percentage of steps GO as well as the full model, $F(2,21) = 3.11$, $p > .05$.

For the dependent variable "mean time," the reduced model containing cost-effective predictors did not predict performance as well as the full model, $F(2,14) = 22.37$, $p < .01$. However, a model containing only mean time on the first trial of Acquisition predicted mean time at two-month retention as well as the full model containing all predictors, $F(4,14) = 1.39$, $p < .05$.

These analyses suggest that measures of performance accuracy were predicted fairly well by the UDA rating and other measures that are fairly cost-effective. However, time to perform a task was not predicted well by any predictor other than a time measure obtained from a previous test.

Four-month retention. For the four-month retention test, the full model for each dependent variable contained as predictors the percentage of soldiers who reported they had performed each task since the two-month retention test, the percentage of soldiers who reported having performed a task during the last month, the UDA rating, the group's average performance on the task at Acquisition, and the mean number of trials to first criterion on the Acquisition test.

The squared multiple correlations for the each of the full models containing all the predictors mentioned above are shown in Table 35. These squared multiple correlations were all significantly greater than zero.

Again, we were interested in determining whether cost-effective variables would predict performance as well as full models containing performance measures which are very costly to obtain. For the dependent variable "Percentage of soldiers GO," we found that a reduced model containing only the UDA rating predicted four-month retention performance as well as the full model containing all the predictors, $F(4,21) = .557$. Thus, using the UDA rating alone, we could predict the percentage of soldiers who passed the tasks.

For the dependent variable "Mean percentage of steps GO," we also found that the UDA rating predicted four-month retention performance as well as the full model containing all the predictors. However, neither the UDA rating nor the set of cost-effective predictors predicted "Mean time" as well as the full model containing all the predictors. The reduced model containing only the performance measures (mean time on the first trial of Acquisition and number of trials to first criterion of Acquisition) predicted four-month retention performance as well as the full model containing all predictors.

The results were consistent with those found for prediction of two-month retention performance. In both sets of analyses, we found that cost-effective variables predicted performance accuracy measures as well as regression models

containing predictors that are more difficult to obtain. However, only reduced models containing performance measures predicted mean time to perform the tasks as well as the full model containing all predictors.

The primary implication of the results of these regression analyses is that it is possible to estimate soldiers' proficiency fairly accurately over time, using relatively inexpensive predictor variables. For certain performance measures (i.e., "Percentage of soldiers GO" and "Percentage of steps GO"), excellent estimates of proficiency can be obtained from the task ratings produced by the UDA. Prediction can be marginally improved through the collection of performance data; however, in our opinion the improvements in prediction would not justify the necessary expense.

APPENDICES

APPENDIX A

COLLECT/REPORT INFORMATION-SALUTE

Equipment Required To Set Up Station and Conduct Test

1	Set binoculars
4-5	Sandbags
1	Pencil
1	Notebook pad
1	Stopwatch

Enemy Scenario

2-3	"Enemy" soldiers dressed in "enemy" uniforms or in civilian clothes with some distinctive feature such as berets, colored arm bands or colored neckbands.
2-3 1	Weapons, combination of individual and crew served; or radio Vehicle, such as 1/4T with US unit markings obliterated and some distinctive marking added on hood and sides.
	Camouflage material

Procedures To Set Up Station

1. Set up sandbags to mark the location of the OP (test site).

2. Locate the enemy scenario between 700-1000 meters from the test site in a location partially camouflaged either naturally or artificially.

3. Some of the "enemy" soldiers should be performing some type of distinctive activity such as performing maintenance on the vehicle, weapons, talking on the radio, reading a map, etc. Since it will be difficult to keep soldiers active in role playing over the extended period required for testing one or more of the "enemy" can be engaged in more normal activity such as eating, sleeping, reading. However, whatever the activity, it should be identifiable and visible.

Procedures To Be Performed Before Testing Each Soldier

1. Remove any notes made by the previous soldier.

Procedures To Conduct and Score Test

1. If the soldier does not have a wristwatch, add the statement "The time is now _____" to the instructions.

2. The information required by the scoresheet is the minimum information that the soldier must give. He may give much additional detail. Be alert to identify the scoresheet information from his report.

3. For PM 3, Reported the location, accept any location description as long as it is included. Direction is not required for this test form. However, do not accept a location description that includes a visual reference such as pointing or indicating "out there."

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

SCORESHEET

COLLECT/REPORT INFORMATION-SALUTE

INSTRUCTIONS TO SOLDIER: During this test you must collect and report enemy information. You should use the binoculars to observe in that (indicate) direction. The location we are at is called OP 1. You will have one minute to observe, and one minute to prepare your report. Then you must tell me what you have observed. Begin.

After one minute observing tell the soldier: You now have one minute to prepare your report. You will not be allowed to observe further. Begin.

After one minute, tell the soldier: You now have one minute to report to me what you have observed. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Reported the size-number of personnel and vehicle.	___	___	_____
2. Reported the activity--what the personnel were doing.	___	___	_____
3. Reported the location--by reference or description.	___	___	_____
4. Reported the unit description--distinctive clothing, patches, symbols, vehicle numbers.	___	___	_____
5. Reported the time the activity was observed.	___	___	_____
6. Reported the equipment-vehicle and weapon descriptions.	___	___	_____
7. Delivered the report in the SALUTE sequence.	___	___	_____
8. Completed the report in one minute.	___	___	_____

TIME

1. Seconds to observe the activity. _____
2. Seconds to prepare the report. _____
3. Seconds to report the activity. _____

USE VISUAL SIGNALS TO CONTROL MOVEMENT (DISMOUNTED)

Equipment Required To Set Up Station and Conduct Test

1 FM 21-60 or FM 7-11 B/1/2
1 Stopwatch

Procedures To Set Up Station

1. Review the drawings of the signals listed on the scoresheet in FM 21-60 page 2-1 thru 2-10 or FM 7-11 B/1/2 page 2-II-A-9.2 and 9.3 until they can be scored without referring to the diagrams.

Procedures To Conduct and Score Test

1. All signals must be given toward (facing) the scorer.

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

USE VISUAL SIGNALS TO CONTROL MOVEMENT
(DISMOUNTED)

INSTRUCTIONS TO SOLDIER: During this test I will announce a series of signals. You must demonstrate the signal announced. You will have 10 seconds to demonstrate each signal from the time I announce it.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Announce: AIR ATTACK			
1. Rapidly crossed and uncrossed arms, fully extended above the head, palms out.	____	____	_____
Announce: ARE YOU READY?			
2. Extended arm straight out; arm raised slightly above horizontal, palm out.	____	____	_____
Announce: I DO NOT UNDERSTAND			
3. Raised both arms to horizontal, placed both hands in front of the face, palms out.	____	____	_____
Announce: AS YOU WERE			
4. Raised both arms over the head, crossed at the wrists, palms out.	____	____	_____
Announce: DOUBLE TIME			
5. Raised the hand to the shoulder, fist closed; pumped the arm up and down rapidly several times.	____	____	_____
Announce: ECHELON RIGHT			
6. Extended the left arm 45° above the horizontal right arm 45° below the horizontal; palms out.	____	____	_____
Announce: DECREASE SPEED			
7. Extended arm to the horizontal sideways, palm to the front or down and waved arm slightly up and down. Arm was not brought above the horizontal.	____	____	_____

SCORESHEET

USE VISUAL SIGNALS TO CONTROL MOVEMENT
(DISMOUNTED) (Cont'd)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Announce: ECHELON LEFT			
8. Extended the right arm 45° above the horizontal; left arm 45° below the horizontal; palms out.	____	____	____
Announce: LINE FORMATION			
9. Extended both arms to the side at the horizontal, arms and hands extended, palms down.	____	____	____

OPERATE RADIO SET AN/PRC-77 AND TRANSMIT AND RECEIVE RADIO MESSAGE

Equipment and Personnel Required To Set Up Station and Conduct Test

2 AN/PRC-77 radios, including battery box (CS-2562/PRC-25), handset (H-189/GR), antenna support (AB-591A), and antenna (AT-892/PRC-25)
2 Batteries BA-4387 (one for NCS and one per day for soldiers being tested)
1 3x5 card
1 Assistant scorer to operate NCS

Procedures To Set Up Station

1. Get an assigned frequency from the Battalion Communications Officer.

2. Set the control station radio to receive and transmit on the assigned frequency.

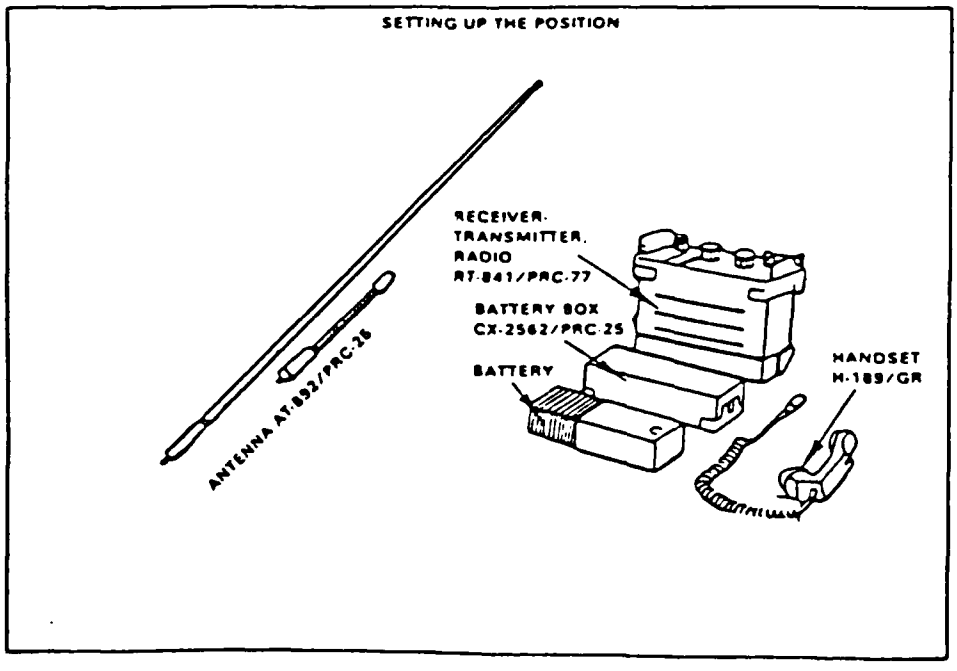
3. Conduct a communications check between the two radios.

4. Select a location for the control station (about 50 meters from the the test site) that minimizes bleeding across frequencies.

5. Write the assigned frequency, the soldier's call sign, and the NCS call sign, on the 3x5 card and tape the card to the test site radio.

Procedures To Be Performed Before Testing Each Soldier

1. Disassemble the test site radio and lay the parts out as shown below.



2. Replace the battery if it has been damaged during previous installation.

3. Set the MC and KC channels to a position that is at least ten numbers from the assigned frequency. Use the same off-set position for each soldier.

4. Set the bank switch to the band opposite the assigned frequency.

5. Turn the radio off.

6. Turn the volume control switch to its lowest setting.

Procedure To Conduct Test

1. When the soldier enters the net the NCS operator should respond MIKE TOO GOLF AIT NINER, THIS IS MIKE TOO PAPA FIFE TREE. PERMISSION GRANTED TO ENTER NET. ROGER, OUT. The soldier is not required to authenticate for this test.

2. Conduct the test for "Transmit and Receive Radio Message" immediately after the soldier finishes the test for "Operate Radio Set AN/PRC-77."

3. If the soldier makes an error with the phonetic alphabet or mispronounces a number during the test for "Transmit and Receive," circle the word where he made the mistake.

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

SCORESHEET

OPERATE RADIO SET AN/PRC-77

INSTRUCTIONS TO SOLDIER: You must assemble the radio and enter the net. Your assigned frequency, your call sign, and the net control station call sign are on the card. You have 2 minutes to install the radio set.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Install			
1. Installed the battery without breakage.	___	___	_____
NOTE TO SCORER: Check the battery after the test.			
2. Locked battery box.	___	___	_____
3. Attached hand set.	___	___	_____
4. Installed antenna base.	___	___	_____
5. Installed antenna.	___	___	_____
6. Turned band switch to band for the assigned frequency.	___	___	_____
7. Set the MC channel to the assigned frequency.	___	___	_____
8. Set the KC channel to the assigned frequency.	___	___	_____
9. Turned the power switch ON.	___	___	_____
10. Turned the volume control switch up.	___	___	_____
11. Completed installation within 2 minutes.	___	___	_____
Enter Net			
INSTRUCTIONS TO SOLDIER, Continued: Now enter the net.			
12. Pressed push-to-talk switch.	___	___	_____
13. Transmitted heading (NCS call sign, THIS IS, and his call sign) before requesting permission to enter net.	___	___	_____

NOTE FROM SCORER: Use of phonetic alphabet and pronounciation of numbers are not scored on this test.

SCORESHEET

OPERATE RADIO SET AN/PRC-77 (Cont'd)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
14. Requested permission to enter net.	___	___	_____
15. Transmitted OVER after requesting permission to enter net.	___	___	_____
16. Released push-to-talk switch after transmission.	___	___	_____

TIME

1. Minutes to install radio. _____
2. Seconds to enter the net. _____

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

MESSAGE #1

SCORESHEET

TRANSMIT AND RECEIVE RADIO MESSAGE
(TRANSMIT)

INSTRUCTIONS TO SOLDIER: You must now transmit this message. You have one minute to study the message. You must spell the work that is underlined. (Wait one minute.) Do you have any questions about the message? Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Transmitted heading:			
a. Before transmitting message.	____	____	_____
b. Using phonetic alphabet and pronouncing numbers correctly: MIKE TOO SEE-AIR-RAH FOW-ER WUN THIS IS MIKE TOO GOLF FIFE NIN-ER	____	____	_____
c. Transmitting proword MESSAGE.	____	____	_____
d. Transmitting OVER after heading.	____	____	_____
NOTE TO SCORER: Use of the proword MESSAGE is not scored on this test.			
2. Transmitted message:			
a. Using I SPELL proword for location: THRODWICK (Optional) I SPELL TANG-GO HOH-TELL OSS-CAH ROW-ME-OH DELL-TAH WISS-KEY IN-DEE-AH CHAR (SHAR)-LEE KEY-LOH THORDWICK (Optional)	____	____	_____
b. Using phonetic alphabet and pronouncing numbers correctly for date time group: WUN SIX WUN NIN-ER TREE ZERO ZOO-LOO AUGUST AIT TOO	____	____	_____
c. Transmitting OVER or OUT after message.	____	____	_____
3. Pressed push-to-talk switch for each transmission.	____	____	_____
4. Released push-to-talk switch after each transmission.	____	____	_____

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

MESSAGE #2

SCORESHEET

TRANSMIT AND RECEIVE RADIO MESSAGE
(TRANSMIT)

INSTRUCTIONS TO SOLDIER: You must now transmit this message. You have one minute to study the message. You must spell the work that is underlined. (Wait one minute.) Do you have any questions about the message? Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Transmitted heading:			
a. Before transmitting message.	_____	_____	_____
b. Using phonetic alphabet and pronouncing numbers correctly: MIKE TOO SEE-AIR-RAH FOW-ER WUN THIS IS MIKE TOO GOLF FIFE NIN-ER	_____	_____	_____
c. Transmitting OVER after heading.	_____	_____	_____

NOTE TO SCORER: Use of the proword MESSAGE is not scored on this test.

2. Transmitted message:			
a. Using I SPELL proword for location: BORDEAUX (Optional) I SPELL BRAH-VOH OSS-CAH ROW-ME-OH DEL-TA ECK-OH AL-FAH YOU (OO)-NEE-FORM EX-RAY BORDEAUX (Optional)	_____	_____	_____
b. Using phonetic alphabet and pronouncing numbers correctly for date time group: TOO NIN-ER WUN FIFE FOW-ER FIFE ZOO-LOO AUGUST AIT TWO	_____	_____	_____
c. Transmitting OVER or OUT after message.	_____	_____	_____
3. Pressed push-to-talk switch for each transmission.	_____	_____	_____
4. Released push-to-talk switch after each transmission.	_____	_____	_____

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

MESSAGE #3

SCORESHEET

TRANSMIT AND RECEIVE RADIO MESSAGE
(TRANSMIT)

INSTRUCTIONS TO SOLDIER: You must now transmit this message. You have one minute to study the message. You must spell the work that is underlined. (Wait one minute.) Do you have any questions about the message? Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Transmitted heading:			
a. Before transmitting message.	____	____	_____
b. Using phonetic alphabet and pronouncing numbers correctly: MIKE TOO SEE-AIR-RAH FOW-ER WUN THIS IS MIKE TOO GOLF FIFE NIN-ER	____	____	_____
c. Transmitting proword MESSAGE.	____	____	_____
d. Transmitting OVER after heading.	____	____	_____
NOTE TO SCORER: Use of the proword MESSAGE is not scored on this test.			
2. Transmitted meassage:			
a. Using I SPELL proword for location: QUAN LON (Optional) I SPELL KEY-BECK YOU (OO)- NEE-FORM AL-FAH NO-VEM-BER LEE-MAH OSS-CAH NO-VEM-BER QUAN LON (Optional)	____	____	_____
b. Using phonetic alphabet and pronouncing numbers correctly for date time group: WUN AIT WUN FIFE TREE ZERO ZOO-LOO AUGUST AIT TOO	____	____	_____
c. Transmitting OVER or OUT after message.	____	____	_____
3. Pressed push-to-talk switch for each transmission.	____	____	_____
4. Released push-to-talk switch after each transmission..	____	____	_____

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

TRANSMIT AND RECEIVE RADIO MESSAGE
(TRANSMIT)

INSTRUCTIONS TO SOLDIER: You must now transmit this message. You have one minute to study the message. You must spell the word that is underlined. (Wait one minute.) Do you have any questions about the message? Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Transmitted heading:			
a. Before transmitting message.	___	___	_____
b. Using phonetic alphabet and pronouncing numbers correctly: NO-VEM-BER TOO SEE-AIR-RAH FOW-ER SEV-EN THIS IS NO-VEM-BER TOO SEE-AIR-RAH FIFE NIN-ER	___	___	_____
c. Transmitting proword MESSAGE.	___	___	_____
d. Transmitting OVER after heading.	___	___	_____
2. Transmitted message:			
a. Using I SPELL proword for location: BRYARTOWN (Optional) I SPELL BRAH-VO ROW-ME-OH YANK-KEY AL-FAH ROW-ME-OH TANG-GO OSS-CAH, WISS-KEY NO-VEM-BER BRYARTOWN (Optional)	___	___	_____
b. Using phonetic alphabet and prounoncing numbers correctly for date time group: WUN SIX WUN NIN-ER TREE ZERO ZOO-LOO OCTOBER AIT TOO	___	___	_____
c. Transmitting OVER or OUT after message.	___	___	_____
3. Pressed push-to-talk switch for each transmission.	___	___	_____
4. Released push-to-talk switch after each transmission.	___	___	_____

MESSAGE #1

Send to M2S41
Resupply at Thordwick 161930Z August 82

You have entered the net.
Your call sign is M2G59.

MESSAGE #2

Send to M2S41
Resupply at Bordeaux 291545Z August 82

You have entered the net.
Your call sign is M2G59.

MESSAGE #3

Send to M2S41
Resupply at Quan Lon 181530Z August 82

You have entered the net.
Your call sign is M2G59.

MESSAGE FOR RETENTION PHASES

Send to N2S47
Resupply at Bryarton 161930Z October 82

You have entered the net.
Your call sign is N2S59.

INSTALL TELEPHONE SET (TA-1/PT)

Equipment Required To Set Up Station and Conduct Test:

Telephone set, TA-1/PT
Field wire, WD-1/TT
Pliers, TL-13A

Procedures To Set Up Station:

1. Lay out the following equipment:

   Telephone set, TA-1/PT (in its case)
   Two 10-foot pieces of field wire
   Pliers, TL-13A (in its case)

Procedures To Be Performed Before Testing Each Soldier:

1. Trim the stripped wire, if any, from the field wire.
2. Discard pieces of wire and insulation.
3. Turn the signal volume control knob on the lowest volume setting.
4. Place the telephone and pliers in their case.

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

INSTALL TELEPHONE SET (TA-1/PT)

INSTRUCTIONS TO SOLDIER: You must install the telephone so it is ready for operation. Assume that the wires are connected to a switchboard. You have three minutes.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Stripped 1/2" to 1" of insulation from each strand of wire.	___	___	_____
2. Inserted one strand of wire into each binding post.	___	___	_____
3. Adjusted signal volume control knob to LOUD.	___	___	_____
NOTE TO SCORER: Score this PM GO if the soldier turns the knob at least beyond the half-way point.			
4. Completes PM 1 through 3 within 3 minutes.	___	___	_____

TIME

1. Minutes to strip field wire. _____

2. Minutes to install wire and adjust signal volume control. _____

IDENTIFY OPPOSING FORCE (OPFOR)
ARMORED VEHICLES

Equipment To Set Up Station and Conduct Test

1 Deck CVI Cards for Combat Vehicle Identification Training Program

Procedures To Set Up Station

1. Select one card showing an oblique view for each of the 10 vehicles on the scoresheet. Be sure no card has identifiable cracks or folds.

Procedures To Conduct and Score Test

1. Hold each card in the soldier's view for about 10 seconds. The soldier may move his head as close to the card as he wants.

2. Vary the order of the cards for each soldier.

3. For the nomenclature vehicles, write any incorrect nomenclature in the Comments column.

Scorer:_____ Soldier:_____

Date:_____ Test #:_____

IDENTIFY OPPOSING FORCE (OPFOR)
ARMORED VEHICLES

INSTRUCTIONS TO SOLDIER: During this test you must identify enemy and friendly armored vehicles. I will show you a photograph of a model of the vehicle. You have 10 seconds to identify the vehicle as Friend or Foe.

PERFORMANCE MEASURES

Friend or Foe ID	GO	NO-GO		GO	NO-GO
1. BMP	____	____	6. BTR 50	____	____
2. Chieftain	____	____	7. BMD	____	____
3. M1	____	____	8. AM 30	____	____
4. ZSU-23	____	____	9. M60A1	____	____
5. T 72	____	____	10. BTR-60	____	____

Trials on Friend or Foe ID _____

INSTRUCTIONS TO SOLDIER, Continued: For the next vehicles you must tell me the nomenclature of each vehicle.

Nomenclature	GO	NO-GO	COMMENT
11. BMP	____	____	_____
12. Chieftain	____	____	_____
13. M1	____	____	_____
14. ZSU-23	____	____	_____
15. T-72	____	____	_____

Trials on Nomenclature _____

MOUNT/DISMOUNT AN/PVS-2 ON M16A1 RIFLE
(MOUNT)

Equipment Required To Set Up Station and Conduct Test

1	M16A1 rifle
1	AN/PVS-2 sight in shipping container
1	AN/PVS-2 weapon adapter bracket
1	Field table or ground cloth
1	Stopwatch

Procedures To Be Performed Before Testing Each Soldier

1. Remove the AN/PVS-2 sight and the adapter from the M16.
2. Thread the adapter wing nut all the way in (clockwise).
3. Turn the two boresight mount lock knobs on the AN/PVS-2 full forward.
4. Place the AN/PVS-2 inside the shipping container.
5. Lay out the M16 and shipping container on the field table or ground cloth.

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

SCORESHEET

MOUNT/DISMOUNT AN/PVS-2 ON M16A1 RIFLE
(MOUNT)

INSTRUCTIONS TO SOLDIER: During this test you must mount the AN/PVS-2 on the M16. You will have 5 minutes to mount the sight. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Unthreaded the wing nut on the adapter to the thread stop.	___	___	_____
2. Pulled the tab away from the adapter.	___	___	_____
3. Slid the mounting ear under the M16 handle.	___	___	_____
4. Positioned the adapter assembly flat against the top of the M16 receiver and all the way forward.	___	___	_____
5. Tightened the wing nut until the tab is pulled tight against the M16 handle and adapter assembly.	___	___	_____
NOTE TO SCORER: Check after test by attempting to move the adapter.			
6. Removed the sight from the shipping container.	___	___	_____
7. Rotated the two oversight mount lock knobs rearward (toward the rubber eyeshield) until they came to a stop against the stop pins.	___	___	_____
8. Slid the boresight mount assembly from the rear into the guide rail of the adapter assembly until it meets the guide rail pin stop.	___	___	_____
NOTE TO SCORER: Check positioning after the test.			
9. Rotated the two locking knobs forward (check locking after test).	___	___	_____
NOTE TO SCORER: Check to be sure the locking knobs are engaged.			
10. Completed mounting in 5 minutes.	___	___	_____

MINUTES

1. Minutes to mount AN/PVS-2. _____

IDENTIFY AND EMPLOY HAND GRENADES

Equipment Required To Set Up Station and Conduct Test

2 Field tables or ground cloth
1 Stopwatch
1 Colored drawings of the following types of grenades:

- Two impact
- Three time delay
- One illumination
- One CS
- One colored smoke
- One WP

Procedures To Conduct and Score Test

1. If the soldier indicates more than one choice remind him that he must select the single best choice.

2. If the soldier indicates an incorrect choice, mark the PM NO-GO and write the nomenclature of his incorrect choice in the COMMENTS column of that PM.

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

IDENTIFY AND EMPLOY HAND GRENADES

INSTRUCTIONS TO SOLDIER: During this test I will give you some situations that require use of hand grenades. You must identify the one best hand grenade, out of those displayed here, to use in that situation. You will have 10 seconds in each situation to indicate to me which hand grenade you choose.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Situation #1: You need to throw a grenade to produce an airburst. Begin.			
1. Selected a time delay grenade.	____	____	_____
Situation #2: You need to throw a grenade at an enemy inside an enclosed bunker. Begin.			
2. Selected an impact grenade.	____	____	_____
Situation #3: You need to throw a grenade to provide a smoke screen. Begin.	____	____	_____
3. Selected the smoke grenade.	____	____	_____
Situation #4: You need to throw a grenade that the enemy cannot throw back. Begin.			
4. Selected an impact detonating grenade.	____	____	_____
Situation #5. You need to throw a grenade at night to provide illumination. Begin.			
5. Selected the illumination grenade.	____	____	_____
Situation #6: You need to throw a grenade to disable but not cause serious injury. Begin.			
6. Selected the CS grenade.	____	____	_____
Situation #7: You need to throw a grenade that you can roll into the enemy position. Begin.			
7. Selected a time delay grenade.	____	____	_____

SCORESHEET

IDENTIFY AND EMPLOY HAND GRENADES (Cont'd.)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Situation #8: You need to throw a grenade to signal your location to an aircraft. Begin.			
8. Selected the colored smoke grenade.	____	____	_____
Situation #9: You need to select a grenade to use against troops in the open that you can cook off for two seconds before throwing. Begin.			
9. Selected a time delay grenade.	____	____	_____
Situation #10: You need to throw a grenade that will both mark the enemy location and produce casualties. Begin.			
10. Selected the WP smoke grenade.	____	____	_____
Situation #11: You need to throw a grenade that will disable but will not injure on detonation. Begin.			
11. Selected the CS grenade.	____	____	_____
Situation #12: You need to throw a grenade at an enemy advancing toward you up a very steep hill. Begin.			
12. Selected an impact detonating grenade.	____	____	_____

LOAD, REDUCE A STOPPAGE, AND CLEAR AN M16A1 RIFLE

Equipment Required To Set Up Station and Conduct Test:

M16A1 rifle
2 M16A1 rifle magazines
6 dummy rounds
Field table
Four-foot stake (if target is not available at about 25 meters)
Stopwatch

Procedures To Set Up Station:

1. Select or position a target at about 25 meters.

2. Load three dummy rounds in each magazine.

Procedures To Be Performed Before Testing Each Soldier:

1. Lock the bolt open.

2. Lay out one loaded magazine.

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

LOAD, REDUCE A STOPPAGE
AND CLEAR AN M16A1 RIFLE

INSTRUCTIONS TO SOLDIER: This test covers your ability to operate the M16A1 rifle. You must first load the weapon and engage the target there (indicate target). You have 10 seconds.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Pointed muzzle toward target while loading.	___	___	_____
2. Inserted magazine until catch engaged.	___	___	_____
3. Tapped upward to seat magazine.	___	___	_____
4. Released bolt by depressing upper portion of bolt catch.	___	___	_____
5. Tapped forward assist.	___	___	_____
6. Placed selector on SEMI.	___	___	_____
7. Squeezed trigger.	___	___	_____
8. Completed PM 1 thru 7 in listed sequence.	___	___	_____
9. Completed loading within 10 seconds.	___	___	_____
INSTRUCTIONS TO SOLDIER: You have experienced a stoppage. You have 10 seconds to reduce the stoppage.			
10. Slapped upward on the magazine to make sure it was seated.	___	___	_____
11. Pulled the charging handle to the rear.	___	___	_____
12. Observed the ejection of the cartridge and checked the chamber for obstruction.	___	___	_____
13. Released the charging handle (must not "ride" handle forward).	___	___	_____
14. Tapped forward assist.	___	___	_____
15. Squeezed trigger.	___	___	_____
16. Completed PM 10 thru 15 in listed sequence.	___	___	_____
17. Completed immediate action within 10 seconds.	___	___	_____

SCORESHEET

LOAD, REDUCE A STOPPAGE AND CLEAR AN M16A1 RIFLE

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
INSTRUCTIONS TO SOLDIER: That completes the engagement. Now clear the weapon. You have 10 seconds.			
18. Removed magazine.	___	___	_____
19. Locked the bolt open.	___	___	_____
20. Returned the charging handle to the forward position.	___	___	_____
21. Placed selector on SAFE.	___	___	_____
22. Looked into receiver and chamber areas.	___	___	_____
23. Released bolt by pressing the upper portion of bolt catch.	___	___	_____
24. Completed PM 18 thru 23 in listed sequence.	___	___	_____
25. Completed clearing within 10 seconds.	___	___	_____

TIME

1. Seconds to load.	_____
2. Seconds to reduce stoppage.	_____
3. Seconds to clear.	_____

BATTLESIGHT ZERO AN M16A1 RIFLE
(ADJUST SIGHTS BASED ON SHOT GROUP)

Equipment Required To Set Up Station and Conduct Test

1 M16A1 rifle
2 Battlesight zero targets (ARI)
1 Dummy round 5.56, or nail
1 Stopwatch

Procedures To Set Up Station

1. Determine if the M16A1 has a Standard Sight System or the Low Light Level Sight System (LLLSS). The front sight for the LLLSS will have a split post; the standard system is solid.

2. If the weapon has the standard sight system make sure the rear sight has the unmarked aperture up (the other aperture will be marked L). If the weapon has the LLLSS, insure the rear sight system has the aperture marked L up (the other aperture is unmarked). In both cases, use the smallest of the two apertures.

3. Using the dummy round or a pencil, punch or mark 6 holes in the target to form two shot groups. Be sure the shot groups are offset the same number of squares in opposite directions: for example 3 right, 4 down; 3 left, 4 up.

Procedure To Conduct and Score Test

1. Alternate shot groups each time you conduct the test.

2. Watch the soldier adjust the sights to be sure he is turning them in the correct direction.

3. Ask him how many clicks he moved each sight.

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

BATTLESIGHT ZERO AN M16A1 RIFLE
(ADJUST SIGHTS BASED ON SHOT GROUP)

INSTRUCTIONS TO SOLDIER: During this test you must complete battlesight zero of the M16. You have fired your initial shot group on the 25 meter zero range. You now must make the sight adjustments based on that shot group. You will not have to fire a confirmatory shot group. Here is the target you fired. You will have 4 minutes to adjust your sight. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Moves the rear sight clockwise to move right/counter-clockwise to move left.	____	____	_____
2. Moved the rear sight _____ clicks.	____	____	_____
3. Moved the front sight up to raise the strike/down to lower the strike.	____	____	_____
4. Moved the front sight _____ clicks.	____	____	_____
5. Completed adjusting the sights within 4 minutes.	____	____	_____

TIME

1. Minutes to adjust the sights. _____ ___

LOAD, UNLOAD AND CLEAR THE M203 GRENADE LAUNCHER

Equipment Required To Set Up Station and Conduct Test

1	M203 grenade launcher
1	40mm grenade (inert)
1	Ground cloth 2'x3'
1	4' Stake (if target is not available at about 20 meters)
1	Waste cloth
1	Stopwatch

Procedures To Set Up Station

1. Select or position an identifiable target at about 20 meters.

Procedures To Be Performed Before Testing Each soldier

1. Wipe sand/dirt from the round and weapon.
2. Lock the barrel closed.
3. Place the safety on SAFE.
4. Lay out the weapon and round on the ground cloth.

Procedures To Conduct and Score Test

1. The soldier may assume any position (standing, prone or kneeling) that he desires. Have him assume the position and pick up the weapon before the start of the test.
2. If the soldier does not perform one of the subtasks (clear, load, or unload) correctly, that subtask must be performed by the scorer before the next portion of the test can be continued.

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

LOAD, UNLOAD AND CLEAR THE M203 GRENADE LAUNCHER

INSTRUCTIONS TO SOLDIER: This test covers your ability to operate the M203 grenade launcher. The launcher and ammunition have been inspected and are clean. The target area is (indicate direction). First you must clear the weapon. You have 10 seconds. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Clear			
1. Pressed barrel latch and slid barrel forward.	___	___	_____
2. Looked into barrel.	___	___	_____
3. Slid barrel to the rear until it locked (clicked).	___	___	_____
4. Kept safety on SAFE.	___	___	_____
5. Kept weapon pointed down range.	___	___	_____
6. Completed clearing within 10 seconds.	___	___	_____
Load			
INSTRUCTIONS TO SOLDIER: You must load the weapon. You have 10 seconds. Begin.			
7. Pressed barrel latch and slid barrel forward.	___	___	_____
8. Inserted round into chamber.	___	___	_____
9. Slid barrel to the rear until it locked (clicked).	___	___	_____
10. Kept weapon pointed down range.	___	___	_____
11. Kept safety on SAFE.	___	___	_____
12. Completed loading in 10 seconds.	___	___	_____

SCORESHEET

LOAD, UNLOAD AND CLEAR THE M203 GRENADE LAUNCHER (Cont'd)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Unload			
INSTRUCTIONS TO SOLDIER: You must unload the weapon. You have 5 seconds. Begin.			
13. Pressed barrel latch and slid barrel forward (round ejects).	___	___	_____
NOTE TO SCORER: Soldier may close and lock barrel. This is not scored.			
14. Kept safety on SAFE.	___	___	_____
15. Kept weapon pointed down range.	___	___	_____
16. Completed unloading in 5 seconds.	___	___	_____
TIME			
17. Seconds to clear weapon.	_____		
18. Seconds to load weapon.	_____		
19. Seconds to unload weapon.	_____		

PERFORM OPERATOR MAINTENANCE ON M203 GRENADE LAUNCHER
AND AMMUNITION (DISASSEMBLY, ASSEMBLY, AND FUNCTION CHECK)

Equipment Required To Set Up Station and Conduct Test

1 M203 grenade launcher with quadrant sight arm installed
1 Cleaning rod section or ball point pen
1 Field table or ground cloth 2'x3'
1 Stopwatch

Procedures To Be Performed Before Testing Each Soldier

1. If the weapon failed the function check, reassemble the weapon.

2. Lock the barrel closed.

3. Place the safety on SAFE.

Scorer:_____ Soldier:_____

Date:_____ Test #:_____

SCORESHEET

PERFORM OPERATOR MAINTENANCE ON M203 GRENADE LAUNCHER AND AMMUNITION (DISASSEMBLY, ASSEMBLY AND FUNCTION CHECK)

INSTRUCTIONS TO SOLDIER: This test covers your ability to maintain the M203 grenade launcher. First you must field strip the grenade launcher. You do not have to disassemble the M16. You will have 2 minutes to disassemble the launcher. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Disassemble			
1. Cleared the launcher before starting disassembly.	____	____	_____
2. Removed the quadrant sight.	____	____	_____
3a. Removed the hand guard.	____	____	_____
Or			
3b. Moved the barrel assembly forward and inserted the clearing rod in the fourth hole on the left side of the hand guard.	____	____	_____
4. Depressed the barrel stop and removed the barrel from the receiver track.	____	____	_____
5. Stopped disassembly when the quadrant sight and barrel (and hand guard if cleaning rod was not used) had been removed.	____	____	_____
NOTE TO SCORER: Stop the soldier and mark PM 5 NO-GO if he attempts any further disassembly of the launcher or M16.			
6. Completed disassembly in 2 minutes.	____	____	_____
Assemble			
INSTRUCTIONS TO SOLDIER: You must now assemble the launcher. You will have 2 minutes. Begin.			
7. Depressed the barrel stop (using the cleaning rod if the hand guard was not removed) and slid the barrel onto the receiver.	____	____	_____
8. Moved the barrel rearward until it locked (clicked).	____	____	_____
9. Installed the hand guard and secured with the slipring.	____	____	_____
10. Installed the quadrant sight and tightened the knurled screw.	____	____	_____

SCORESHEET

PERFORM OPERATOR MAINTENANCE ON M203 GRENADE LAUNCHER AND AMMUNITION (DISASSEMBLY, ASSEMBLY AND FUNCTION CHECK) (Cont'd)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Function Check			
INSTRUCTIONS TO SOLDIER: You must now perform a function check. You will have 1 minute. Begin.			
12. Depressed the barrel latch and moved the barrel forward.	____	____	_____
13. Closed the barrel (clicked).	____	____	_____
14. Placed safety on FIRE.	____	____	_____
15. Pulled the trigger (firing pin released).	____	____	_____
16. Held trigger to the rear and cocked launcher by opening and closing barrel.	____	____	_____
17. Released trigger.	____	____	_____
18. Pulled trigger (firing pin released).	____	____	_____
19. Cocked launcher by opening and closing barrel.	____	____	_____
20. Placed safety on SAFE.	____	____	_____
21. Pulled trigger (firing pin did not release).	____	____	_____
22. Completed function check in 1 minute.	____	____	_____

TIME

1. Minutes to disassemble launcher.	_____
2. Minutes to assemble launcher.	_____
3. Minutes/seconds to perform function check.	_____

PREPARE THE DRAGON FOR FIRING

Equipment Required To Set Up Station and Conduct Test

1	DRAGON round, inert, complete with shocks, sling, bipod strap and electrical connector cover
1	DRAGON tracker and carrying bag complete with lens cover and electrical connector cover
1	Aiming stake 2"x5' (if identifiable aiming point is not available)
1	Stopwatch

Procedures To Set Up Station

1. Select an aiming point (or erect the aiming stake) approximately 100 meters away.

Procedures To Be Performed Before Testing Each Soldier

1. Reassemble the tracker round into its carrying configuration. Secure the bipod with the bipod strap.

2. Replace the lens cover and electrical connector cover on the tracker. Stow the tracker in the carrying bag.

3. Extend one of the foot adjusts to its near maximum extension.

Procedures To Conduct and Score Test

1. Do not evaluate the position that the soldier assumes when checking the round cant.

2. Do not evaluate the weapon cant.

3. The soldier must either adjust the extended foot or adjust the opposite foot (PM 12).

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

PREPARE THE DRAGON FOR FIRING

INSTRUCTIONS TO SOLDIER: For this test you must prepare the DRAGON for firing. The direction of fire is that stake (indicate). The round has been inspected and is serviceable. You will have 2 minutes to prepare the DRAGON for firing. Begin.

PERFORMANCE MEASURES	GO	NO-GO	
1. Unsnapped the bipod strap.	___	___	_____
2. Lowered the bipod until it locked in the vertical lock position (forward shock comes off).	___	___	_____
NOTE TO SCORER: The forward bipod brace must be engaged.			
3. Depressed the bipod friction lock and extended the bipod legs.	___	___	_____
4. Removed the electrical connector cover from the round.	___	___	_____
5. Removed the tracker from the carrying bag after the round was prepared.	___	___	_____
6. Removed the protective cover from the tracker electrical receptacle.	___	___	_____
7. Secured the tracker receptacle cover to the tracker forward shock absorber.	___	___	_____
8. Placed the tracker guide pins in the slots of the tracker support rails.	___	___	_____
9. Used both hands and pushed the tracker to the rear until it locked in place.	___	___	_____
NOTE TO SCORER: Check locking after the test is completed by attempting to move the tracker.			
10. Removed the tracker lens cover after the tracker was mounted.	___	___	_____
11. Secured the tracker lens cover to the tracker forward shock absorber.	___	___	_____
12. Adjusted the foot adjust.	___	___	_____
13. Completed preparing the DRAGON in 2 minutes.	___	___	_____
TIME: Seconds/Minutes to prepare the DRAGON for firing.			_____

STOP BLEEDING (ARM OR LEG) AND IDENTIFY SIGNS OF AND TREAT FOR SHOCK

Equipment and Personnel Required To Set Up Station and Conduct Test

1 Felt tip marker, red
4 Field first aid dressings
1 Backpack with blanket or filler
2 Ponchos
1 Assistant scorer to serve as casualty

Procedures To Set Up Station

1. Mark wound on casualty's forearm.

2. Roll up casualty's sleeve to allow access to wound.

3. Remove field dressing from its package.

Procedures To Be Performed Before Testing Each Soldier

1. Untie bandages and cloth strips, if tied.

2. Refold field dressing so that the white face of the pad is into the middle of the dressing and lay it by the casualty.

3. Have the casualty secure his pistol belt and web gear, button the top button of his shirt and trousers, tie his boots, and blouse his fatigue pants.

4. Have casualty lie on his back on one poncho.

5. Fold other poncho and place it at the casualty's feet.

Scorer:_____ Soldier:_____

Date: _____ Test #:_____

SCORESHEET

STOP BLEEDING (ARM OR LEG) AND
IDENTIFY SIGNS OF AND TREAT FOR SHOCK

INSTRUCTIONS TO SOLDIER: The casualty has a bleeding wound on his right forearm. He has no other wounds and the bone is not broken. You have 2 minutes to treat the wound.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
Put on Field and Pressure Dressings			
1. Treated wound before treating for shock.	___	____	_____
2. Applied field dressing by:			
a. Avoiding touching wound.	___	____	_____
b. Putting white (sterile) side of pad to wound.	___	____	_____
c. Avoiding touching white side of pad.	___	____	_____
d. Wrapping bandage around the arm.	___	____	_____
e. Tying tails in a square knot.	___	____	_____
3. Elevated wound over the heart.	___	____	_____
INSTRUCTIONS TO SOLDIER, Continued: The wound is still bleeding.			
4. With wound elevated, pressed bandage to wound.	___	____	_____
5. Placed casualty's arm across his chest.	___	____	_____
6. Completed PM 1-5 within 2 minutes.	___	____	_____

Prevent Shock

INSTRUCTIONS TO SOLDIER: The casualty is experiencing symptoms of shock. You have two minutes to treat for shock.

SCORESHEET

STOP BLEEDING (ARM OR LEG) AND
IDENTIFY SIGNS OF AND TREAT FOR SHOCK (Cont'd)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
7. Loosened clothing and equipment:			
a. top button of shirt	___	___	_____
b. pistol belt	___	___	_____
c. web belt	___	___	_____
d. top button of trousers	___	___	_____
e. blousing garters	___	___	_____
f. laces on boots	___	___	_____
8. Elevated casualty's feet (on backpack).	___	___	_____
9. Covered casualty with poncho.	___	___	_____
10. Completed PM 8-10 within 2 minutes.	___	___	_____

TIME

1. Minutes to put on field and pressure bandage.	_____
2. Minutes to prevent shock.	_____

SPLINT A FRACTURE

Equipment and Personnel Required To Set Up Station and Conduct Test

1 Scorer assistant
1 Wire ladder splint
2 Splint boards, 4" x 30"
4 Cloth binding strips, 20"
2 Cloth sling strips, 52"
Padding material

Procedures To Set Up Station

1. Lay the splint boards, wire splint, cloth strips, and padding by the assistant.

Procedures To Be Performed Before Testing Each Soldier

1. Untie the binding strips and sling strips.

2. Remove padding material from splint boards.

Procedures To Conduct and Score Test

1. After the soldier ties the splints have the assistant stand up. If the soldier does not begin to secure the splinted arm, ask him if he is finished. If he starts to tie the arm down, let him continue and score as if you had not asked him. If he says he is finished score PM 5 NO-GO but tell him to secure the arm.

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

SCORESHEET

SPLINT A FRACTURE

INSTRUCTIONS TO SOLDIER: This soldier has a broken right elbow. It is a closed fracture and is not bleeding. Assume he is conscious and breathing. Splint his arm. You have 6 minutes.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Padded splints.	___	___	_____
2. Placed one splint on each side of the arm.	___	___	_____
3. Positioned splints so they both extended beyond the wrist and at least one extended beyond the shoulder.	___	___	_____
4. Tied splints:			
a. At two points above and two points below the fracture.	___	___	_____
b. So that no tie was over the fracture.	___	___	_____
c. So that all knots were against the splint.	___	___	_____
5. Secured splinted arm to the body:			
a. One strip midway between the elbow and the shoulder.	___	___	_____
b. One strip midway between the elbow and the wrist.	___	___	_____
6. Completed splint within 6 minutes.	___	___	_____

TIME

1. Minutes to complete splint.	_____

DETERMINE AZIMUTH USING A COORDINATE SCALE AND PROTRACTOR

Equipment Required To Set Up Station and Conduct Test

1	1:50,000 Map
3	Black lead pencils (#2 1/2 or #3)
1	Field table
1	Folding chair
1	Pencil sharpener
1	Coordinate scale and protractor--GTA 5-2-3
1	Red lead pencil
1	Scratch pad
10	Back azimuth situations (See attached)
1	Stopwatch

Procedures To Set Up Station

1. Select 10 situations on the master map for azimuth readings, each situation consisting of two points. The two points should be within 1 1/2" of each other and should be readily identifiable features (intersections, hilltops, buildings). Separate the situations as much as possible on the map. Label the points in pairs alphabetically (AB, CD, EF, . . . ST). Determine the grid azimuth for each pair (from A to B, from C to D, etc.) on the master map and make a list of the correct azimuths.

2. Transfer the points to the test map(s) and label the pairs of points (AB, CD, etc.) with the red pencil. Carefully circle or arrow the precise point.

Procedures To Be Performed Before Testing Each Soldier

1. Write the letters of the next points to be tested in the INSTRUCTIONS for the first part of the test on the scoresheet. Write the azimuth for these points in PM 7 on the scoresheet.

2. Select the next subtraction back azimuth situation from the attached list. Write the azimuth in the INSTRUCTIONS and the back azimuth in PM 10 on the scoresheet.

3. Select the next addition back azimuth situation from the attached list. Write the azimuth in the INSTRUCTIONS and the back azimuth in PM 13 on the scoresheet.

4. Erase the lines drawn by the previous soldier.

5. Lay out a sharpened pencil and the protractor on the map.

6. Remove any used sheets from the scratch pad.

7. Use new test situations for each retest.

DETERMINE AZIMUTH USING A COORDINATE SCALE AND PROTRACTOR

Procedures To Conduct and Score Test

1. Insure the soldier has identified the correct actual point to determine the azimuth from and to and does not confuse it with the location of the identifying letter. Point to or describe the point as necessary.

2. For the back azimuths, the soldier may write down the azimuth as you give it to him. Repeat the azimuths if necessary.

3. It is not necessary that the soldier specify degrees to get a GO, however, you should instruct him that the answer is in degrees if he omits it.

DETERMINE AZIMUTH USING A COORDINATE SCALE AND PROTRACTOR

BACK AZIMUTH SITUATIONS

A Subtraction

	Azimuth	Back Azimuth
1.	312°	132°
2.	220°	40°
3.	190°	10°
4.	304°	124°
5.	186°	6°

B Addition

	Azimuth	Back Azimuth
1.	175°	355°
2.	66°	246°
3.	162°	342°
4.	11°	191°
5.	157°	337°

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

SCORESHEET

DETERMINE AZIMUTH USING A COORDINATE SCALE AND PROTRACTOR

INSTRUCTIONS TO SOLDIER: During this test you must first determine the grid azimuth from your location at point _____ (indicate) to point _____ (indicate). You will have three minutes to determine the azimuth. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Drew a line using the straight edge between point A and point B.	___	___	_____
2. Drew the azimuth so it extends beyond the edge of the protractor.	___	___	_____
3. Placed the index (center) of the protractor directly over his location and maintained that position during the reading.	___	___	_____
4. Positioned the protractor so that 0° was at the north and 90° to the east.	___	___	_____
5. Positioned the protractor so that the straight edges were parallel to the NS-EW grid lines.	___	___	_____
6. Started at the 0° and read to the right (clockwise) until the point where the straight line intersected the protractor.	___	___	_____
7. Read the azimuth as _____ (within one degree).	___	___	_____
8. Completed reading within three minutes.	___	___	_____

INSTRUCTIONS TO SOLDIER: Your next task is to find a back azimuth. You have determined your azimuth to a point as _____. What is the back azimuth to your location? You have 45 seconds to determine your back azimuth. Begin.

9. Subtracted 180 from the given azimuth.	___	___	_____
10. Determined the back azimuth as _____.	___	___	_____
11. Completed the back azimuth within 45 seconds.	___	___	_____

SCORESHEET

DETERMINE AZIMUTH USING A COORDINATE SCALE AND PROTRACTOR (Cont'd)

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
INSTRUCTIONS TO SOLDIER: Again you must find a back azimuth. You have determined your azimuth to a point as _____. What is the back azimuth to your location? You have 45 seconds to determine your back azimuth. Begin.			
12. Added 180 to the given azimuth.	___	___	_____
13. Determined the back azimuth as _____.	___	___	_____
14. Completed the back azimuth within 45 seconds.	___	___	_____

TIME

1. Minutes to determine azimuth.	_____
2. Seconds to determine back azimuth (subtraction).	_____
3. Seconds to determine back azimuth (addition).	_____

CONVERT AZIMUTHS
(MAGNETIC OR GRID)

Equipment Required To Set Up Station and Conduct Test

1	1:50,000 military map with grid-magnetic angle exceeding 5°
2	Pencils, black lead
1	Scratch pad
10	Grid-magnetic situations (see below)
1	Field table
1	Folding chair
1	Stopwatch

Procedures To Set Up Station

1. Select 5 magnetic azimuths and 5 grid azimuths. Convert each to grid or magnetic. Record the original azimuth and the corrected azimuth on an answer sheet. (NOTE: Record the answer both in degrees and minutes if the angle so indicates. Also record the conversion rounded off to the nearest half degree. Ignore annual drift in the conversion.)

Procedures To Be Performed Before Testing Each Soldier

1. Select the next two test situations. Write the magnetic azimuth in the space in the initial instructions on the scoresheet and the grid azimuth in PM 4.

2. Change the test situation for each retest.

3. Remove all used sheets from the scratch pad.

Procedures To Conduct and Score Test

1. If the soldier asks about annual drift, tell him to ignore it.

2. The soldier may give his answer either exactly in degrees and minutes or in degrees rounded off to the nearest half degree (if applicable).

Scorer:_____ Soldier:_____

Date: _____ Test #: _____

SCORESHEET

CONVERT AZIMUTHS
(MAGNETIC OR GRID)

INSTRUCTIONS TO SOLDIER: During this test you must complete two problems converting magnetic azimuths to grid azimuths and grid azimuths to magnetic azimuths. I will give you an azimuth and tell you whether to find grid or magnetic. Do not make any marks on the map sheet; use the note pad provided to write down the azimuth I give you. Announce the new azimuth as soon as you find it. You have a magnetic azimuth of _____. What is the grid azimuth? You have 3 minutes to determine the correct azimuth. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Located the declination diagram on the map.	___	___	_____
2. Determined the value of the G-M angle.	___	___	_____
3. Added the value of the G-M angle to given magnetic azimuth.	___	___	_____
4. Determined the grid azimuth as _____.	___	___	_____
5. Completed determining the grid azimuth within 3 minutes.	___	___	_____

INSTRUCTIONS TO SOLDIER: You have a grid azimuth of _____. What is the magnetic azimuth? You have 3 minutes to find the magnetic azimuth. Begin.

6. Located the declination diagram on the map.	___	___	_____
7. Determined the value of the G-M angle.	___	___	_____
8. Subtracted the value of the G-M angle from the given grid azimuth.	___	___	_____
9. Determined the magentic azimuth as _____.	___	___	_____
10. Completed determining the magnetic azimuth within 3 minutes.	___	___	_____

TIME

Minutes/seconds to determine grid azimuth. _____

Minutes/seconds to determine magnetic azimuth. _____

APPENDIX B

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

PUT ON AND WEAR AN M17-SERIES PROTECTIVE MASK

INSTRUCTIONS TO SOLDIER: At this station you will put on your protective mask. Take off your headgear right now. You will not be required to secure the straps or adjust the drawstring on the hood. You will have 15 seconds to complete the task. Begin.

PERFORMANCE MEASURES (Sequence is scored.)	GO	NO-GO	COMMENTS
1. Takes the mask out of the carrier. Puts it on and clears it by cupping the hand firmly over the outlet valve opening and blowing hard. (For the M17A1 mask, the soldier must also cover the voicemitter with the other hand.)	____	____	_____
2. Checks the seal of the mask by placing the hands over the inlet valves and breathing in.	____	____	_____
3. Pulls down the hood and covers all exposed skin. Zips the hood if it has a zipper.	____	____	_____
4. Does all the performance measures in sequence.	____	____	_____
5. Completes the task in 15 seconds.	____	____	_____
6. The mask is adequately sealed.	____	____	_____

NOTE TO SCORER: Place your hands over the inlet valves and have the soldier breathe in. The mask should collapse toward the face.

TIME

Seconds to put on mask.	_____	_____	_____

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

REPLACE THE FILTERS IN AN M17-SERIES PROTECTIVE MASK

INSTRUCTIONS TO SOLDIER: At this station your task will be to exchange the filters on this mask. You have 15 minutes to complete the task. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. The right filter element is installed on the right side and the left filter element is installed on the left side.	____	____	_____
2. The bottom of nosecup is laid on top of the chin stop.	____	____	_____
3. The nosecup and pouch flaps are buttoned with the top flap over the bottom flap.	____	____	_____
4. The inlet valves are seated firmly on the connectors so that the word "TOP" (on the rim of the inlet valves) faces toward the eyelenses.	____	____	_____
5. The collar is seated under the connector flange without gaps or bulges.	____	____	_____
6. Completed the task within 15 minutes.	____	____	_____

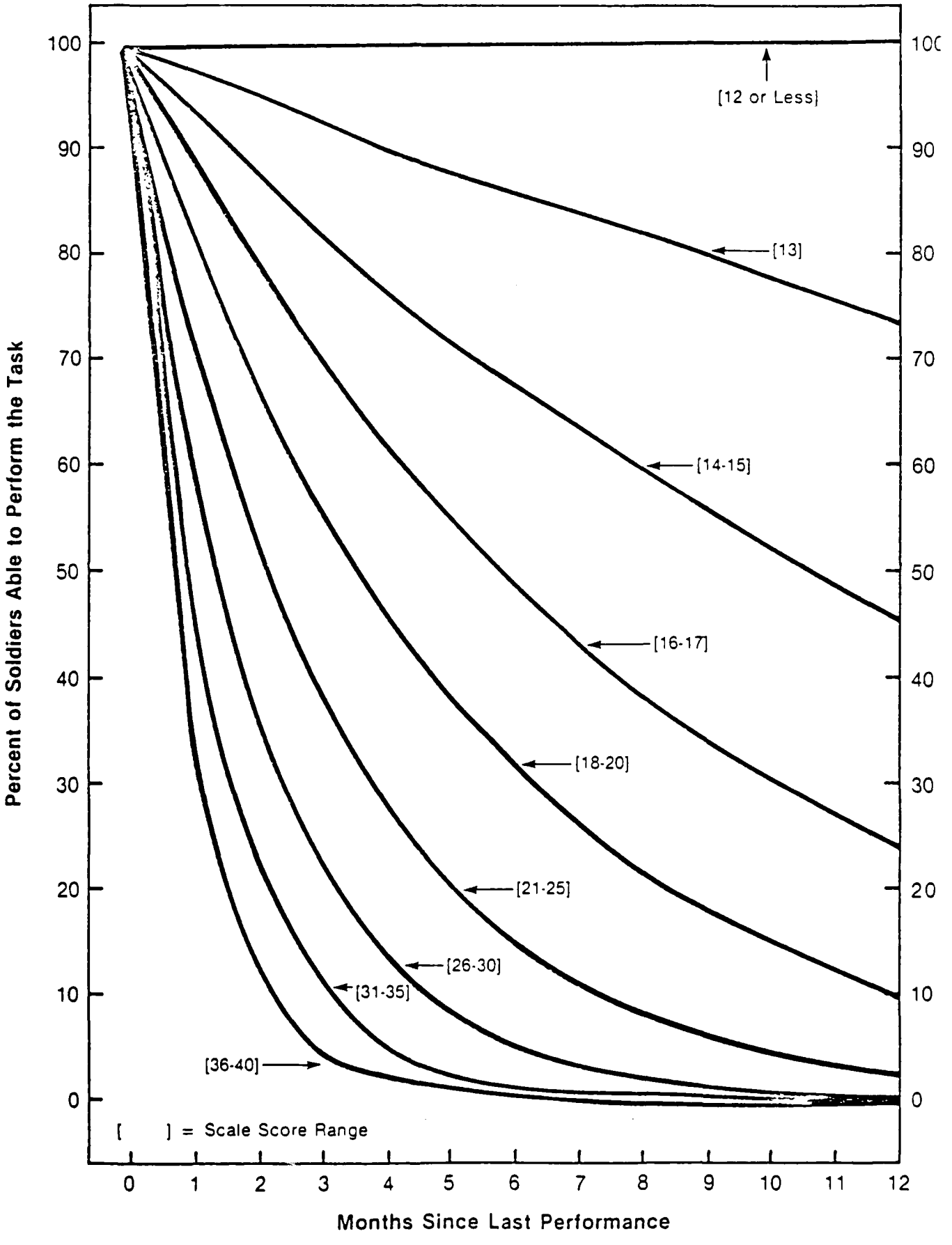
TIME

Minutes to replace filters. _____ _____ _____

UDA Task Rating Form

Task Name/ Description:	Scale Questions								
	Question 1 Job/ Memory Aid	Question 2 Job/ Memory Aid Quality	Question 3 Number of Steps	Question 4 Interstep of Cueing	Question 5 Mental/ Cognitive Require-ments	Question 6 Number of Facts	Question 7 How Hard to Remember	Question 8 Physical Require-ments	Retention Scale Score Total
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Performance Prediction Nomograph



Scorer:_____ Soldier:_____

Date:_____ Test #:_____

SCORESHEET

PREPARE AN M72A2 LAW FOR FIRING;
RESTORE M72A2 LAW TO CARRYING CONFIGURATION

INSTRUCTIONS TO THE SOLDIER: Pick up the LAW and sling it on your shoulder. Assume that you have inspected the LAW and found it to be undamaged. You will be required to prepare the LAW for firing at the (designate target). You may use any firing position you choose. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Removed sling assembly.	____	____	_____
2. Extended the LAW until it was locked in position.	____	____	_____
3. Placed the LAW on the shoulder with the front end of the LAW toward the target.	____	____	_____
4. Checked the backblast area before arming the LAW.	____	____	_____
5. Armed the LAW, while keeping it on the shoulder.	____	____	_____
6. Completed all performance measures within 30 seconds.	____	____	_____

TIME

Seconds to prepare LAW. _____ _____ _____

Scorer:_____ Soldier:_____

Date:_____ Test #:_____

SCORESHEET

INSTALL AND FIRE/RECOVER AN M18A1 CLAYMORE MINE

INSTRUCTIONS TO SOLDIER. At this station, you will be required to set, aim, arm, simulate firing, and recover the Claymore mine. The aiming point is (designate the aiming point). You have 15 minutes.

PERFORMANCE MEASURES			GO	NO-GO	COMMENTS
1. Kept M57 firing device in his possession while installing and recovering the mine.			____	____	_____
2. Installed the M18A1 Claymore mine.			____	____	_____
	Yes	No			
a. Tied shorting plug end of firing wire to stake at the firing point.	___	___			
b. Moved to mine emplacement point while unreeling firing wire.	___	___			
c. Removed mine from bandoleer and installed mine on ground facing direction of enemy.	___	___			
3. Aimed the mine.			____	____	_____
	Yes	No			
a. Slit-type peepsight: 50 meters to the front of the mine and 2 1/2 meters (8 feet) above the ground.	___	___			
OR					
Knife-edge sight: 50 meters to the front of the mine and at ground level.	___	___			
NOTE TO SCORER: Check aim after soldier arms mine.					
b. Secured firing wire 1 meter to rear of mine using stake.	___	___			
4. Tested firing circuit.			____	____	_____
	Yes	No			
a. Performed test on M57 firing device and M40 test set.	___	___			
NOTE TO SCORER: Must plug firing device into test set and activate handle while observing window of set.					
b. Connected firing wire to test set.	___	___			
c. Placed sandbag over blasting cap.	___	___			
d. Performed test on firing circuit.	___	___			
NOTE TO SCORER: Must activate handle while observing window of set.					

Scorer:_____ Soldier:_____

Date:_____ Test #:_____

SCORESHEET

USE VISUAL SIGNALS TO CONTROL MOVEMENT
(DISMOUNTED) - SQT

INSTRUCTIONS TO SOLDIER: During this test I will announce a series of signals. You must demonstrate the signal announced. You will have 10 seconds to demonstrate each signal from the time I announce it.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
nnounce: ATTENTION			
1. Extended arm sideways, slightly above horizontal, palm to the front; waved arm to and away from the head several times.	____	____	_____
Announce: ASSEMBLE			
2. Raised arm vertically overhead, palm to the front, and waved in large horizontal circles.	____	____	_____
Announce: ADVANCE TO (Designate area)			
3. Faced designated area, held the arm extended to the rear (palm up), then swung arm overhead in the direction of desired movement until it was horizontal (palm down).	____	____	_____
Announce: HALT			
4. Raised the hand upward to full extent of the arm, palm to the front.	____	____	_____
Announce: DISPERSE			
5. Extended either arm vertically overhead and waved the hand and arm to the front, left, right and rear with the palm toward the direction of each movement.	____	____	_____
Announce: WEDGE FORMATION			
6. Extended both arms downward to the sides at an angle of 45° below the horizontal, palms to the front.	____	____	_____
Announce: ACTION (Designate area)			
7. Raised fist to shoulder level and thrusted it several times in direction of action.	____	____	_____
8. Demonstrated each signal within 10 seconds.	____	____	_____

Scorer:_____ Soldier:_____

Date:_____ Test #:_____

SCORESHEET

INSTALL THE M16A1 BOUNDING ANTIPERSONNEL MINE
(WITH/WITHOUT TRIPWIRES)

INSTRUCTIONS TO THE SOLDIER: You will be required to install an M16A1 antipersonnel mine without tripwires within 10 minutes. You must use the M25 fuzing wrench. Do not apply too much pressure because the plastic threads are fragile. Begin.

PERFORMANCE MEASURES (Sequence is scored where noted.)	GO	NO-GO	COMMENTS
1. Removed hexagonal shipping plug from the mine and inspected the fuze well.	____	____	_____
NOTE TO SCORER: Soldier must use the fuzing wrench to remove the plug.			
2. Screwed the M605 practice fuze in the mine using the M25 fuzing wrench.	____	____	_____
3. Dug hole and buried the mine up to the bottom of the release pin ring.	____	____	_____
NOTE TO SCORER: Release pin and pressure prongs must be exposed.			
4. Removed the locking safety pin.	____	____	_____
5. Removed the interlocking pin. (None on the plastic training fuze.	____	____	_____
6. Covered the mine until only the pressure prongs were above ground level.	____	____	_____
7. Removed the positive safety pin.	____	____	_____
8. Completed performance measures 4 through 7 in sequence.	____	____	_____
9. Completed all performance measures within 10 minutes.	____	____	_____

TIME

Minutes to install mine. _____ _____ _____

Scorer: _____ Soldier: _____

Date: _____ Test #: _____

SCORESHEET

DETERMINE MAGNETIC AZIMUTH USING A COMPASS

INSTRUCTIONS TO SOLDIER: You must determine the azimuth from your position to (designate target). Announce the azimuth as soon as you have determined it. You have one minute. Begin.

PERFORMANCE MEASURES	GO	NO-GO	COMMENTS
1. Opened the compass so that the cover formed a straight edge with the base.	___	___	_____
2. Moved the eyepiece to its rearmost position.	___	___	_____
3. Held the compass as follows:			
a. One thumb through loop and index finger of the same hand along the side.	___	___	_____
b. Other thumb between the eyepiece and bezel ring with index finger extended along the side.	___	___	_____
c. Fingers of both hands interlocked under the compass.	___	___	_____
4. Pulled elbows into sides of the body.	___	___	_____
5. Oriented body and compass to point, if required, by rotating his body.	___	___	_____
6. Determined magnetic azimuth within three degrees of recorded azimuth.	___	___	_____
7. Determined magnetic azimuth within one minute.	___	___	_____

TIME

1. Seconds to determine azimuth. _____

TARGET _____

Scorer:_____ Soldier:_____

Date:_____ Test #:_____

SCORESHEET

ENGAGE ENEMY TARGETS WITH HAND GRENADES

INSTRUCTIONS TO THE SOLDIER: You are now required to throw at least one hand grenade within the 10-meter circle around the target. You will be given two grenades. You must begin in the prone position behind cover. You may use any throwing position, but you must return to the prone position behind cover after each grenade is thrown. Continue throwing until I tell you to stop. You will have 30 seconds to do this task. Begin.

PERFORMANCE MEASURES (Sequence is not scored.)	GO	NO-GO	COMMENTS
1. Held grenade in throwing hand with thumb over safety lever.	____	____	_____
2. Removed safety pins and clips while behind cover.	____	____	_____
3. Took cover after throwing each hand grenade.	____	____	_____
4. Remained exposed no longer than 3 seconds for each throw.	____	____	_____
5. Threw one hand grenade within the circle around the target.	____	____	_____
6. Completed all performance measures within 30 seconds.	____	____	_____

APPENDIX C

USER'S DECISION AID

Instructions:

The following pages contain a series of eight questions that will help you decide which tasks require retraining--those on which soldiers are most likely to suffer loss of proficiency over time if they do not practice.

Here are the steps to follow:

1. List the tasks to be rated in the first column of the Task Rating Form. Then answer a set of questions about each task.

2. Read each question and decide which answer you think best describes the task you are rating. Note that there is a Scale Value assigned to that answer.

3. Record the Scale Value of your answer on the Task Rating Form, writing it in the box corresponding to that question.

4. The statement following each answer will tell you which question to answer next.

Question 1. Are job/memory aids available to the soldier when he performs the task?

Scale Value

1	• Yes. Go to Question 2, Page 2.
4	• No. Go to Question 3, Page 3.
	• Need more information. Read Definition below.

Definition

Job/Memory Aids are devices which help the soldier remember how to do a task or the order the steps of the task should be performed.

For example:

- Mnemonics such as S-A-L-U-T-E
- Labels or printed instructions on a piece of equipment
- Symbol or color code systems
- Procedure manuals, but only if they can be used while actually doing the task.

Now re-read and answer Question 1.

Question 2. How would you rate the quality of the job/memory aids?

Scale Value

1 • Very good - a soldier can do the task without any additional instructions. Go to Question 5, Page 5.

2 • Good, but incomplete - a soldier would need some (additional) instruction. Go to Question 3, Page 3.

3 • Poor - the soldier could not do the task without additional instruction. Go to Question 3, Page 3.

• Need more information. See Definition below.

Definition

The quality of a job/memory aid is rated according to its completeness; that is, on the amount of additional information or experience a soldier using the aid would still need to do the task.

For example:

- A poor aid provides only a very general, non-specific clue as to what the soldier should do (e.g., a warning light or buzzer).
- A "good" aid provides information to the soldier on what to do, but not necessarily how to do it (e.g., a check list, "idiot lights" on a car).
- A very good aid provides information both on what to do and how to do it (e.g., a technical manual that can be used while doing the task).

Now re-read and answer Question 2.

Question 3. How many steps are required to do the task?

Scale Value

1	• One step. Go to Question 5, Page 5.
2	• Two to five steps. Go to Question 4, Page 4.
3	• Six to ten steps. Go to Question 4, Page 4.
4	• More than ten steps. Go to Question 4, Page 4.
	• Need more information. Read Definition below.

Definition

For purposes of this rating exercise you may use the number of performance steps listed in Army technical manuals or other references as the number of steps needed to complete the task.

Use the following guidelines if a reference manual is not available or if a task has not been broken down into performance steps.

A step is a discrete physical or cognitive activity within a task, which has a discernible beginning and ending point, and which must be performed in order to complete a task correctly.

A task may consist of one, a few, or many steps.

Tasks involving assembling or disassembling a piece of equipment tend to be multi-step tasks. Tasks involving purely mental actions (e.g., making a choice among various options, estimating distances, identifying facts, persons or objects) tend to be one-step tasks.

Now re-read and answer Question 3.

PERFORMANCE PREDICTION TABLE

Question 4. Do the steps tend to follow a natural sequence in which completing one step suggests what the next step should be?

Scale Value

1	• Most of the steps provide interstep cueing.	Go to Question 5, Page 5
2	• Many of the steps provide interstep cueing.	
3	• Only a few of the steps provide interstep cues.	
4	• None of the steps provides any form of cueing.	
	• Need more information. Read Definition below.	

Definition

This question rates the degree to which the steps within a task "cue" or force the soldier to make the next correct step. Such a task contains steps which tend to be logically, physically, or spatially connected to each other.

For example:

- Disassembling a piece of equipment - a soldier would tend to continue the task until all components have been taken apart
- Completing a numbered form
- Repeating the same steps several times (e.g., removing the lug nuts from a wheel, where removing the first "cues" the soldier to remove the remaining lugs).

Uncued tasks tend to be unstructured, to require no particular sequence of steps. They tend to have numerous alternative steps that could be taken, or the correct step is not obvious or is contrary to what seems logical.

Now re-read and answer Question 4.

Question 5. What are the mental or cognitive requirements of this task?

Scale Value		
1	• No mental processes	Go to Question 6, Page 6
4	• Simple mental processes	
6	• Complex mental processes	
8	• Very complex	
	• Need more information. Read Definition below.	

Definition

This question rates the difficulty of the thought process posed by a task on the soldier.

A task requires virtually no mental processing if the task is essentially reflexive, or repetitive (e.g., marching in line, disassembling a weapon).

A task requires simple mental processing if it involves making gross comparisons (e.g., switch on/off); estimating size, range weight or distance; performing simple computations or memorizing names, terms or facts.

A task requires complex mental processes if it requires the soldier to make a choice or decision based on subtle but discrete clues (e.g., prioritizing fixed targets, interpreting a photograph, discriminating among types of aircraft or vehicles).

A task requires very complex mental processes if it involves making a decision based on a continuous flow of detailed, technical information (e.g., planning, prioritizing moving targets in combat).

Now re-read and answer Question 5.

Question 6. How many facts, terms, names, rules or ideas must a soldier memorize in order to do the task?

Scale Value		
1	• None.	Go to Question 8, Page 8.
2	• A few (1 - 3)	Go to Question 7, Page 7
3	• Some (4 - 8)	
4	• Very many (more than 8)	
	• Need more information.	Read Definition below.

Definition

This question rates the amount of information a soldier must learn and retain in memory in order to do the task.

For example:

- Military nomenclature
- Conversion formulas
- Codes or call numbers
- Technical names, specifications or tolerances
- Doctrinal principles or rules of thumb

Now re-read and answer Question 6.

Question 8. What are the physical performance demands of the task?

Scale Value		
1	• None	Go to Page 9
2	• Small but noticeable amount of control required	
3	• Considerable amount of control needed	
4	• Very heavy demand for physical control	
	• Need more information. See Definition below.	

Definition

A task requires almost no physical performance control if it involves only sheer physical strength or simple, reflexive actions (e.g., pushing, lifting, carrying, pushing a button).

A small but noticeable physical demand is imposed by tasks such as driving a small nail or adjusting a carburetor screw.

A considerable amount of control is needed for tasks such as driving a manual transmission car or tracking a moving target.

A task requiring a very considerable physical demand would be the repair of a very delicate piece of equipment.

Now re-read and answer Question 8.

For each task that has been rated, add the scale values assigned to the eight questions. Record the sum in the column labeled "Total." This is the Retention Scale Score for the task.

In order to interpret the Retention Scale Score, you may use either the Performance Prediction Table or the Performance Prediction Nomograph.

PERFORMANCE PREDICTION NOMOGRAPH

Note that the percentage of soldiers able to perform a task decreases with time, whether the task is easy or difficult. The harder the task, the faster the rate at which performance deteriorates, and the greater the loss. Over half the soldiers remember how to do an easy task after a year, but only 35 percent can do a difficult-to-remember task after one month.

Remember, however, that this table cannot tell the user what the predicted performance of any individual soldier will be. The table should be used for planning group practice or retraining only.

Performance Prediction Table

Months Since Last Performance	Retention Scale Scores								
	12 or Less	13	14-15	16-17	18-20	21-25	26-30	31-35	36-40
0 Months	100%	100%	100%	100%	100%	100%	100%	100%	100%
1 Month	100	98	94	89	83	73	60	48	35
2 Months	100	95	88	79	68	53	36	23	12
3 Months	100	93	82	70	56	38	22	11	4
4 Months	100	90	77	62	46	28	13	5	2
5 Months	100	88	72	55	38	20	8	2	1
6 Months	100	86	68	49	32	15	5	1	0
7 Months	100	83	64	43	26	11	3	1	0
8 Months	100	82	60	38	21	8	2	0	0
9 Months	100	80	56	34	18	6	1	0	0
10 Months	100	78	52	30	15	4	1	0	0
11 Months	100	76	49	27	12	3	0	0	0
12 Months	100	74	46	24	10	2	0	0	